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EDITORIAL NOTES.

The National Gas Exhibition of 1913.

POPULAR taste changes. We see it all around us. The things that attracted and pleased at one time gradually fall into the rear, and eventually are left behind. Gas exhibitions are not exempt. The old forms of exhibition are now out of date; and their power of attraction and usefulness is practically dead. Something new has to be brought into being—something that will now attract, something that will demonstrate and educate, something that will be talked about, and something that will have lasting beneficial effect. The prestige of the gas industry in this regard has to be maintained in the eyes of the world. In certain of the outer halls of the "White City" at Shepherd's Bush, those to whom the task has been delegated of producing a large advertisement of the modern achievements of the gas industry in manufacture, but chiefly in application, have set themselves to produce a scheme next year that will harmonize with modern tastes and requirements, and place the accomplishments of the gas industry in the right light. Bit by bit, their plans unfold themselves. The curtain was raised on them at the time of the Manchester conference of the British Commercial Gas Association, and again at the meeting of the Society of British Gas Industries last week. The major part of the exhibition is to be a co-operative affair. Long avenues lined by a medley of stands, fitted up and equipped according to the notions of their several tenants, are to be suppressed, excepting in a part to be devoted specially to those firms who cannot, from the nature of their goods—such as manufacturing plant—have their representation incorporated in the collective display. The exhibition will thus be distinguished from all precedent; a new precedent will, in fact, be set. This has been made possible by the Council of the Society of British Gas Industries having, we gather from the remarks of the President (Mr. Corbet Woodall), consented to the principle of the subordination of the individuality of firms, in order to make the display as popularly attractive as possible. From what can be seen, this will be a profitable piece of self-sacrifice. On second thoughts, the term "self-sacrifice" does not strike us as being correct; for it is no self-sacrifice to give up that which will be unattractive, and therefore unprofitable, for that which will be magnetic and therefore profitable. The subordination of individuality, the President believes, may to-day, in this particular matter, be taken as the greatest element in the anticipation of success. So must think all who consider changing circumstances and the popular disinclination to be attracted by anything that has not in it the elements of novelty.

This show is going to have in it all the elements of novelty; and it will make an altogether unique display. It is going to be a demonstration of gas use on an unprecedented scale, if the gas industry as a whole will supply the funds to make it so. The demonstration, it is hoped, through the novelty of its display, will make it worth the while of all gas concerns in the United Kingdom to get representative people to pay it a visit when in London; and it can be easily arranged by advertising in the local press that free admission tickets will be supplied to anyone visiting the Metropolis. Special trips from all quarters will be paid by Gas Committees of Municipal Authorities and Boards of Directors of Gas Companies, and by the technical Gas Associations. The attractive power of the exhibition will be determined by the form the exhibition takes; and we have now in the British Commercial Gas Association, with the aid of the Institution of Gas Engineers and the Society of British Gas Industries, such organizing machinery as the industry never before possessed—each and all bent on the one object of making this exhibition something that will work good universally for the gas industry now and for a long time to come. The space at command will allow of room after room being fitted as they should be fitted for lighting and heating—from the drawing-room down to the kitchen and bathroom. Palatial rooms and the rooms of the cottager it is hoped to bring into the scheme. The demonstration of the use of gas in industrial processes is also of the project. It is an ambitious scheme—a scheme comprehending interest for all, whatever be their place in the social or industrial systems. The plans, ambitious as they are, can be carried out if the whole gas industry will recognize its indivisibleness and its mutuality of interest. Money is the one thing that dominates such a scheme; and that money it is "up to" the gas industry to find. The industry must not be found wanting in this respect. It has to show to the world and to its competitors that its premier position as the provider of light, heat, and power, is capable of being maintained by its achievements in invention. It has to make every visitor to the exhibition leave it an advertising agent of the power of the industry in economically serving the wants of communities, and improving the homes of rich and poor alike, as well as the sanitation of our cities and towns, by the conveniences it offers.

It was pointed out by Mr. F. W. Goodenough at the meeting of the Society of British Gas Industries that a fresh boom has commenced in gas supply; and that news comes of large increases in consumption from all quarters of the country. Therefore now is the time to concentrate effort on following up this boom by an exhibition unprecedented in character. There is nothing like opportunity. Let the gas industry grasp the opportunity. This, too, is the centenary year of the beginning of gas supply distributed through the streets of the Metropolis; next year sees the celebration of the jubilee of the Institution of Gas Engineers. Let us open the new century of gas supply in a manner worthy of an old-established and a flourishing industry; let us bid God-speed to our technical organizations in the manner that will best illustrate the progress that technical work has accomplished. There are a few already asking themselves in what way they are going to personally benefit from this display of progress? We put to them the converse question, What is to be gained by paddling along in the old way, and never doing anything out of the ordinary to give a fillip to public interest? After all, it is public interest in our achievements that is the main factor in promoting success in all business undertakings. Therefore, let all who can do part, all who ought to do part, in any scheme for the promotion of the expansion of the business and work of the industry do it—not in a niggardly spirit, but with the liberality and enthusiasm that will show their broad interest in letting the world know the position at which the industry has arrived in serving requirements in the matter of light, heat, and power, and their interest too in subscribing to the further attainment of a common purpose. Let that interest stand uppermost; the smaller points around which argument wanders will then sink into insignificance. This is to be a "National" Gas Exhibition. It requires all the units of our industrial enterprise to make it so.

From the Side of the Makers of Fire-Clay Goods.

THE manufacturers of fire-clay goods last Wednesday broke the long silence on their own behalf. Since Mr. F. J. Bywater, in 1908, brought forward his strong indictment of their methods, and there was a menace of greater competition from German sources, the English manufacturers have borne the attacks upon them with a reserve that in itself suggested that the impeachment was not altogether unmerited. But they took what was perhaps the better course of entering heartily, through their section of the Society of British Gas Industries, into the work of the Committee on Refractory Materials (appointed by the Institution of Gas Engineers), and on the Committee had direct representation. Between 1908 and 1912, the situation has changed; and last Wednesday saw Mr. G. H. Pearson-Perry, the Chairman of the Fire-Clay Section of the aforesaid Society, occupying the

platform at their meeting, and giving an account of recent developments in the production of refractory goods from fire-clay. From the paper and discussion, there rose above all other pertinent matters the evidence of the welcome of the manufacturer at the intrusion of the user into his domain, to assist in producing the goods of the required standard qualities, of a recognition of interests between the maker and the user being common, and of an intention to henceforth live up to the standard specifications, existing or (if experience dictates) modified.

It is patent that the manufacturers are conscious that the criticisms levelled against them a few years ago were justified; but if repeated to-day, they would not be so. Mr. Perry himself admits that the inroads the Refractory Materials Committee have made into the province of fire-clay manufacturers was "no doubt fully warranted," and Mr. Albert Cliff in the discussion confessed that the quality of fire-clay material had been prejudicially affected by the absurd cheapness of material that obtained for some time through cut-throat competition. This reason, standing alone, is hardly sufficient, as the change in supervisory methods, manual and chemical, that have been introduced by the front line of manufacturers since the critic confronted them, suggests that there were looseness and informality in this department which were not pardonable. In fact, Mr. Perry confesses as much in saying that the department in which the manufacturers may be *supposed* to be lacking had been in the manipulation of the materials, and in following up this somewhat cryptic statement by one of more pronounced meaning, "That this may have been the case in time back "*I do not deny*." However, we can let bygones be bygones; for nothing but good is issuing from first criticism, and then the ensuing co-operation. Changes in works' methods take time; but for some long while past users have found an improvement in the resultant material, and are satisfied that the test of time and use will fully confirm their views in this respect, and that foreign competition need no longer be hung over the manufacturers' heads, like a veritable sword of Damocles.

The paper by Mr. Perry, couched as it is in friendly language, and expressive as it is of the desire of co-operation, throws a direct light on the difficulties with which the manufacturers have to contend, and the extraordinary care that must be exercised at every step of their operations to secure the best results. Control from beginning to end is imperative, and particularly in chemical conditions; for if materials are improperly mixed containing the wrong percentages of alkalies, silica, alumina, and titanium, the high degree of refractoriness that is essential will not be realized. The necessity and effects of adequate weathering are also described, as well as an insistance upon the importance of the introduction of the right percentage of grog in the material—in fact, routine and essentials take a large part in this interesting paper, and throw light upon the volume of work that has to be undertaken in this particular line of manufacture. Even now there is not confidence that all difficulty and all that is essential have been laid by the heels through the collaboration of the users and the manufacturers. The Committee themselves, it will be remembered, only put forward their standard specifications as tentative, and subject to the changes suggested by experience; and Mr. G. H. Timmis thinks it will not be very long hence before the specifications will have to be altered But there are suggestions that as, through the improving developments that have been made, the user now gets a better material, he should pay a proportionately higher price for it. We are quite at one with the manufacturers that they should receive proper payment for the value they give. We are not believers in such commercial bargainings as induce producers to neglect or curtail quality in order to meet the oppressive tactics of those who employ mercilessly the competitive force to sweat the last penny out of the producer. But at the same time the fire-clay manufacturers must not forget that these developments in processes of which Mr. Perry speaks, and which the manufacturers have been compelled to adopt owing to the dissatisfaction expressed by their patrons, are necessary to their very existence; and they know, as well as we do, that it would be a suicidal policy for them now to retrace their steps to where certain of them were before 1908. Some of the increased expense must be regarded as incidental to the preservation of their business; but we are not so mean as to say that improved quality has no title to an improved monetary value. Therefore something is due to the manufacturers as compensation for the "increased costs entailed by the more modern stipulations." But we must and do submit that the consumer ought not to be expected to pay the whole costs involved in the defence of the fire-clay manufacturers' own businesses.

Reference has been made to the suggestion that ere long there will have to be modifications in the standard specifications. This may be so. But the manufacturers are suggesting that there should be a specification of use as well as of production. This was their "day out." And they were not going to let users off without a certain amount of criticism. Unquestionably, there have been cases where the criticism has been justified. We have known of retort furnaces that have been allowed to get out of hand, and damage has ensued. There are notable cases in which alleged incompetent manipulation of furnaces has had disastrous effects. There are instances where unsuitable fire-clay material has been used for particular purposes. The fire-clay manufacturer asks whether it is fair that his product should have to bear the blame for all this, as is customary? He also asks for just as much scientific handling of the goods he produces as is demanded of him now in the manufacture of these goods. Generally speaking, the goods do get this proper scientific handling. But it must be admitted that we have seen some isolated premature failures of retort-benches of a somewhat disastrous kind—they have mostly been extreme cases. We think too the criticism of Mr. Timmis as to shrinkage and sinking of benches erred on the extreme and exceptional side; and there was not surprise that Mr. J. W. Broadhead, on behalf of the builders of retort-benches, should repudiate as a general experience the little sketch provided by Mr. Timmis. Most specifications of modern retort-bench work do not give the latitude for any such considerable contraction happening; and, as Mr. Broadhead points out, it is expansion and not contraction that is looked for when raising the temperature of retort-settings—the contraction comes when they are let down. However, all this discussion is good; and the co-operation that has now been established is the best phase of the whole matter.

The Distribution and Discussion of Papers.

THE trouble that there has been at meetings of the Institution of Gas Engineers over the absorption of time by the reading of papers of inordinate length, and the consequent curtailment of the time for discussion, together with what has at times been tantamount to insult to authors by squeezing their contributions into a few minutes at the tail-end of the sittings, and giving their work in preparing papers but the slenderest recognition, has more than once of recent years drawn attention to the question of the best manner of dealing with papers written for the purpose of discussion at meetings. The Southern District Association at their recent meeting tried, as an experiment, what has long been the practice of the Institution of Mechanical Engineers—that is, to distribute the papers well before the meeting for the study of the members, and then for the authors to merely give a *précis* of them at the meeting before the discussion. The object of doing this is a double one—to provide more time for discussion, and to enable members to consider the topics dealt with in the papers, and to prepare for taking part in the discussion with something tangible, instead of (as frequently happens) occupying time with a string of desultory remarks that neither enlighten nor interest. We were rather disappointed over the result of the first experience of the Southern Association. There were three papers prepared for the meeting; but it was as obvious as anything could be that those who had studied the papers and took part in the discussions were in the minority. It may be said that the subjects of the contributions hardly lent themselves to any very extensive discussion; but that was not the view of the President (Mr. B. R. Green), who said that "when "there were papers such as they had got that day, about "questions upon which there was likely to be considerable "discussion, it would be a great advantage to have an "extended time for discussion." Further it may be that the members had not fully grasped the intention of the early distribution of the papers. But the fact remains that the speeches that were made showed that only in a few cases had there been prior preparation. It would not be fair to suggest that this one trial should be made the final arbiter of future procedure. The members have to be educated into the new order of things; and there is not the slightest reason why it should not be as successful in our gas organizations as in connection with other professional

bodies. Mr. Green also mentioned that the Council of the Institution of Gas Engineers were thinking of pursuing a somewhat similar course; and there was a probability of their adopting it. We hope they will try it if the authors can be persuaded to prepare their papers in sufficient time for useful distribution before the meeting. One good effect must surely ensue from the new method, and that is that those speakers who are in the habit of absorbing time by giving vent to a string of vapid commonplace remarks will, by the quality of the comments of those who prepare themselves for the occasion, be effectually silenced if they have any self-respect.

Illumination Developments.

A CLOSE watch must be kept upon movements affecting illumination, in order that, now that there is actual official recognition of the importance of the question of illumination, and official inquiry has already commenced, the gas industry may not be left out in the cold in the matter of any larger developments that may take place. Our electrical friends are very keen about getting much their own way in inquiries of this nature. It will be remembered how they tried, and nearly succeeded, in being the sole representative of power agents in the investigation by a Committee of the Textile Institute into the question of power in the textile industry. Fortunately, the electricians were removed from the favoured position they had secured on that Committee. Illuminating Engineering Societies are gaining ground; and they are very active in forcing the general subject on the attention of the powers that be, with the result that there can be no question the next few years will see some important movements in this connection. This matter of official recognition, and possibly official surveillance, has prominence given to it in the report that Mr. Leon Gaster read at the meeting of the Illuminating Engineering Society last Tuesday. There are Committees of the Society sitting at the present time, considering the best methods for school and library lighting, and the subject of the avoidance of glare. The work of these Committees should be very useful, if there is a proper balance of representation upon them, and their recommendations are free from bias, as a puritanical illuminating engineer's recommendations ought to be, but as a rule are not. However, whatever their recommendations, there is no doubt they will appeal to some of the authorities concerned.

It was also seen recently that the annual report of the Chief Inspector of Factories contained a valuable record by Mr. D. R. Wilson of his investigations into the lighting of factories. This is all preliminary to something larger. During last summer, the Home Secretary, in reply to an inquiry, stated that it was proposed to appoint a Departmental Committee on the subject of illumination—presumably in connection with the lighting of factories and such-like places where numbers of workers are employed. It is understood that this Committee will be appointed before the rising of the House for the Christmas vacation. This, again, is a matter upon which the eyes of the gas industry must be kept; for if the Committee are prepared to receive evidence, it will be necessary for the representative organizations of the industry to see that its interests are properly represented. There is also the question of the prevention of accidents in factories. The insurance companies, it appears, are having the point forced upon their attention that good lighting means a diminution of accidents. Naturally there is the greater liability to accident in places that are ill-lighted than in places that are well-lighted. The object of forcing this matter on the notice of insurance companies is to obtain a reduction of insurance premium in places that are well illuminated as against a heavier premium where places are badly lighted. Quite outside this consideration of a reduction of insurance premium, we should imagine that manufacturers in these days would readily see that, in the interests of their own business and of the maximum production of works, the best possible lighting—the lighting of best quality, reliability, and economy—is to their advantage, while the opposite condition means loss.

All these things the gas industry must keep in view, and take the necessary action in informing those in authority—departmental committees or other authorities, manufacturers, and insurance companies—precisely as to the capacity of the gas industry in meeting requirements, as well as the merits of its commodity, whether it be for light, heat, or power.

Sleepy-Headed Gas Companies.

THERE has been poured into our ears the plaint of a contracting builder whose operations are of a ubiquitous nature, and who has had experience of many gas companies in his time. This experience has induced the opinion that there is about as much difference in the business methods of gas companies as there is between a motor car and a farm tumbrel. He says that in some cases—the London companies for example, when he has had anything to do with building in their border areas—he has hardly started pegging out the foundations before a representative of the gas company concerned is seeking an interview with him to know when the company's men can lay-in the gas-pipes. But he has not to look far afield to find another gas company of whose business methods he can only speak in terms of the utmost contempt. The movements of the company are tortoise-like; and their treatment is of the kind that belongs to other days, and not to these days of competition. This particular company, he says, never thinks of approaching him for information as to the laying-in of gas-pipes; they leave their electric competitors in the enjoyment of an open field long after building has started. If the builder writes to the company inviting them to put in gas-pipes, he does not get more than a post-card acknowledgment until probably the walls are ready for plastering, and in several cases, he says, his patience has been exhausted, and he has consented to the electricity suppliers wiring the houses. In the district of this particular sleepy-headed company there are rows of houses that are wired, and the tenants use the electric light, solely (he knows this as a positive fact, having been the builder) because of the immobility of the gas company and the absolute indifference that is shown by them. Yet this builder is friendly disposed to gas, on account of its manifold convenience and reliability.

This is not the first time there has been information concerning this sort of thing for that particular district; and it is not pleasant to hear it. We have heard of negligence for weeks in giving attention to orders for gas-lighting fittings and connections, of no personal attention and weeks' delay in complying with orders for gas-fires, and of want of prompt rectification when consumers complain as to deficient gas supply through the service-pipes requiring clearing. A little delay in the supply and fixing of gas-fires is perhaps pardonable just now; but a curt post card and a long delay, without any personal explanation, is not calculated to make good friends. We are not going to mention any name in this connection; but it is really time the methods of fifty or sixty years ago were superseded by up-to-date ones. The question of saving a few pounds by the persistence in archaic rules and modes is unimportant compared with permanent loss of business, and the creation of such dissatisfaction that a builder is driven to talk to others of the treatment he and householders generally receive. If the management of any company finds that the condition of affairs described here fits the local circumstances, then the best advice that can be given to that management is to overhaul the people and the methods of the distribution department, and put things on a proper footing. Otherwise, perhaps fresh management would be found advantageous to the company. To the best of our knowledge and belief, such cases as the one referred to are isolated; and it is not representative of the commercial methods generally obtaining in the gas industry.

A Popular Illumination Primer.

The ignorance of the public on the subject of the use and misuse of artificial light is somewhat remarkable. Its education has been neglected in this regard, and instinct does not seem to have been of an order to compensate for the deficiency of knowledge. The Illuminating Engineering Society of America has issued a little primer headed "Light: Its Use and Misuse," written in popular style, and valuable because of this, and the excellence of the advice that it tenders to the user of any form of artificial light. Such a primer is sure to have an excellent effect. It cannot be expected that it will be the means of converting all who read it from the errors of their light-using ways; but if it sows the seeds of correct illumination, and the consequent prevention of injury to the eyes, we may be sure that the seed will germinate, and gradually a new order of things will be extensively brought about. As an example of the advice given, the reader is warned not to judge illumination by the brightness of the lamps, nor

to work in a flickering light, nor to use unshaded lights. All humanity is prone in some matters to do things wrongly when they have no guidance; and we feel convinced that, in this particular matter, the primer of our American friends will be of vast use. The Society has given us permission to print the pamphlet in full; but we have not been able to include the illustrations. From the reproduction of the text, however, readers will be able to see the character of the primer. There is a prospect of the Illuminating Engineering Society in this country adapting it to home purposes, and publishing it for distribution. This project was referred to at the meeting of the Society last Tuesday, as reported elsewhere. We hope that in the adaptation the members of the Council interested in the gas industry will have an opportunity of making suggestions. For instance, in the note as to "How to figure cost of light," we should like to see the lower figure altered to 1 in the sentence, "Most individual inverted gas-mantle burners take from 3 to 3½ cubic feet per hour." In view of the large adoption in this country, too, of high-pressure lighting, it would be well to drop in the words "low-pressure" after "individual."

"M. O. H." in the "Sanitary Record."

The letters "M. O. H." signify membership of the Society of Medical Officers of Health; and membership of that Society is held in high esteem by most of our prominent medical officers. We occasionally see the "Sanitary Record;" and in it there appears a page of notes by "M. O. H." In the notes in the issue for Nov. 8, reference is made by the writer to the recent cookery lectures and demonstrations at the offices of the Society; and it is easy to detect in the sentences employed a note of sarcasm. "M. O. H." says "at the Society of Medical Officers of Health for example, we have a group of three or four sanitarians showing (with the assistance of the Secretary) the poor how to cook, and filling the hearts of the gas and gas-cooker makers with joy by demonstrating the ease with which water will boil if exposed in a suitable receptacle to the heat generated by burning gas." If "M. O. H." had nothing better to say of those highly informative lectures, which covered a wider field than he indicates, then he had better have omitted reference to them altogether. We were represented at those lectures and demonstrations, and therefore know something more of them than any person can possibly do whose information is confined to the limited particulars in newspaper paragraphs. We cannot, having that knowledge, understand any attempt—feeble as manifestly is the effort before us—being made by a medical officer of health to belittle the educational work of his colleagues at the Society's own offices. If perchance it should be that the "M. O. H." who writes these notes in "Sanitary Record" is (we do not know it is so) the "M. O. H." who recently recommended the eviction, from underground conveniences in the borough of Marylebone, of gas-heating apparatus, on account of fumes, overheating, and bad ventilation (which ought not to exist with proper appliances and fittings), and the installation instead of delightfully cool and expensive electric radiators, naturally we could find a reason for what appear to be the slighting remarks in the note in our contemporary. We may be able by a little investigation to establish the identity of the "M. O. H." in question. Meantime we may remind readers that the matter of these Marylebone underground conveniences was dealt with in the "Electricity Supply Memoranda" published in the "JOURNAL" for Nov. 5.

The Position of Trade Unions.

The question of whether a trade union could be sued for damages at all, in connection with such a matter as a libel, even if the act complained of was not committed in contemplation or in furtherance of a trade dispute, was dealt with by the House of Lords some days ago, in the course of a judgment in respect of a claim for conspiracy and libel. The plaintiffs in the action claimed that the defendants (a trade union to whom the Trades Disputes Act of 1906 applied) had conspired to represent, and had untruly represented, them as a firm who dealt unfairly by their workmen. The defendants promptly applied to have the name of the Society struck out of the action, on the grounds, firstly, that a trade union could not be sued at all in such an action, and, secondly, that even if the Trades Disputes Act was to be read as applying only if there was a trade dispute, it did not appear on the face of the proceedings that the acts complained of had arisen out of such a trade dispute. The Court of Appeal, by a majority, allowed the application; and it was from this judgment the plaintiffs appealed—unsuccessfully—to the House of Lords. Though the Act in question is cited as the Trades Disputes Act, sub-section 1 of section 4 provides that an action against a trade union, whether of workmen or masters, in respect of any tortious act alleged to have been committed by, or on behalf of, the union, shall not be entertained by any Court—making no restriction confining the tortious act to one in contemplation of, or in furtherance of, a trade dispute. During the hearing it was contended that such a restriction ought to be implied. In support of this, the title of the Act was pointed to, and it was argued that the scheme of the first three sections, which dealt only with trade disputes, showed that the Act was to be interpreted as so confined, and that it could not be supposed that the Legislature intended to free trade unions from liability to the extent which a literal reading of the section quoted would indicate. With this contention the Lord Chancellor disagreed, as did also the four other Lords who heard the case with him. In the course of his judgment (as reported in "The Times"), he pointed out that, though it was provided that the Act might be cited by the short title of the Trades Disputes Act, the governing title was that which introduced the Statute as an Act to provide for the regulation of trade unions and trade disputes. The object of the first three sections was to regulate trade disputes; while the fourth section appeared to carry out the other intention indicated by the initial title, by laying down new law as to trade unions. He could find no context in the Act read as a whole which indicated an intention to cut down the literal meaning of the wide language of sub-section 1 of section 4. In sub-section 2, a distinction was drawn between the liability of a trade union and of its trustees; and there was no justification for importing the provision restricting liability enacted in sub-section 2 into the words of sub-section 1.

PERSONAL.

Mr. LAWRENCE FLETCHER has resigned from the Board of the Welsbach Light Company, Limited, and from the Managing Directorate of the Company, which he has held for many years.

Mr. D. RITCHIE, of Stoke-upon-Trent, has been appointed Works Assistant to the Aldershot Gas, Water, and District Lighting Company—a position for which applications were recently invited in the "JOURNAL."

We are gratified to be able to announce that Professor W. A. BONE has been elected an Honorary Member of the American Gas Institute, in recognition of the interesting lecture he delivered at last year's meeting, on Surface Combustion.

Mr. HERBERT WILLIAM KAYE, Assistant to Mr. Frank Higginson, the Manager of the Broadstairs Gas Company, has been appointed, out of upwards of fifty applicants, Gas Manager to the Milton Regis Urban District Council, in succession to Mr. A. H. Andrews. Mr. Kaye is a native of Elland.

Mr. A. SHARP, who for some time past has been engaged with the Royston and District Gas Company, Limited, has relinquished this position in order to become Secretary of the Wentworth Silkstone Colliery Company, Limited, near Doncaster. Prior to his departure, he was entertained at a farewell supper at the Queen's Hotel, Barnsley, when felicitous reference was made to the esteem in which he was held by the people of Royston.

Mr. H. G. RITCHIE, the Engineer and Manager of the Fraserburgh Corporation Gas-Works, has been appointed to a similar post by the Directors of the Irvine Gas Company, Limited. Mr. Ritchie, who is a son of the Superintendent of the Kirkcaldy and Dysart Water-Works, has been in charge of the Fraserburgh Gas-Works for the last four years, and was previously Assistant-Manager at the Kirkcaldy Gas-Works. Mr. Ritchie holds, among other technical certificates, the City and Guilds of London Institute first-class honours certificate in "Gas manufacture."

We are pleased to learn that, by a decree dated the 1st inst., made on the proposition of the Minister of Commerce and Industry of France, M. EMILE G. ST. HUBERT CHAMON and M. EMIL L. F. CORNNAULT have been raised from the rank of Chevalier to that of Officier of the Legion of Honour. M. Chamon is a Director of the important group of firms trading under the title of the Compagnie pour la Fabrication des Compteurs et Matériel d'Usines à Gaz, of Paris; and M. Cornnault is a prominent member of the gas profession in France. He is a Director of the Paris, Paris Suburban, and Marseilles Gas Companies, one of the original members and a Past-President of the Société Technique du Gaz, and a Past-President of the French Society of Civil Engineers. He was the author, some years ago, of a pamphlet, on the London Gas Companies; and a translation of it, as well as of his Inaugural Address to the Society of Civil Engineers, was given in the "JOURNAL" at the time.

ELECTRICITY SUPPLY MEMORANDA.

Municipal Provision of Electric Motors—Views of Traders and Contractors—No Analogy with the Gas Cooking Stove—Charges for Energy for Gas-Compressors—Diesel Engine Accidents—Death at 200 Volts—Metallic Filament Licences—Hove Municipalizers.

MUNICIPAL trading as a principle is objected to by a large number of people; but a goodly proportion of the number adopt a very passive attitude in regard to the matter until there are omens abroad that their own pockets are going to be assailed by the energetic municipal trader. Then the fat is in the fire; and the sizzling noise that is heard is sufficient evidence of the fact. There are other people, too, who, though passionately opposed to municipal trading, are willing to sell their principles if their own pockets are not affected, and they can see that the abuse of the principle may result in a little scoring being done off commercial rivals. Of course, this sort of thing is not cricket; and the "Electrical Review" might make a note of the fact. Recently the Electricity Committee of the Leeds Corporation were proposing to borrow £10,000 for establishing a department for the hiring of motors. They seemed to be labouring under the view that there are an immense number of manufacturers in the city area who are in such an impecunious position that they cannot afford to buy their own electric motors; and so the Electricity Department, acting the part of the Good Samaritan, contemplated crossing over and helping them by providing motors for their hire. But there were the motor traders and the electrical contractors. They raised such a *furore* over the matter that the Council sent the scheme back, and it is still in abeyance. The irony of the situation is the greater in view of the fact that the party in the Council (they are strong political partizans in the Leeds Council) who brought forward the matter have had their majority seriously clipped down at the November elections.

The mistake the Electricity Department made was in trying to carry the scheme over the heads of the motor makers and electrical contractors of the city; and if there is no reply to Mr. Henry S. Ingleby (of Messrs. Ingleby and Co., Limited), who has been writing on the subject to the "Electrical Review," it would also appear that the Department have not kept faith in this connection with the motor makers and traders. If this is so, then the makers and traders are additionally justified in their unbending attitude towards the scheme. Vague promises of wiring were held out to the contractors as being one result of the Department embarking on this motor hiring-out project. The makers were also told that the scheme was for the hiring of motors only, and that the department would not permit their actual sale. At all events, Mr. Ingleby says the makers were so informed. But what is found when the scheme is formally put forward? It contains a clause stipulating that "the hirer be permitted to purchase a motor hired by him at any time at a price not lower than the net figure at which it stands in the books of the Corporation." This, supposing there is not another side to the story, is not the correct way to treat reputable manufacturers and traders in the city; and it does not conduce to the credit of municipal administration. Who can blame the firms concerned for the uncompromising attitude they have taken up in this connection? At the moment, rather than give way they seem more disposed, if needs be, to have the Leicester and Sheffield trouble all over again; and perhaps they have a stronger case and cause. They contend that the demand for motors on hire and hire-purchase systems is adequately supplied by the firms in the city; but this submission has been utterly ignored by the Corporation Electricity Department. Before Mr. Ingleby's letter appeared, that great *anti*-municipal organ, the "Electrical Review," while recognizing the importance of the principle involved in this matter, added that "there are some things which a public authority is by nature better fitted to handle [than whom?], and one of these, as it appears to us, is motor hiring." The smile expansive cannot be resisted. Once admit that by nature a public authority is better fitted than any other body or person to handle motor hiring, then the municipal traders are given the right to say that, this being so, and their ability to handle motors being only possible through their trading in other directions, the principles held by those antagonistic to municipal trading must go. The "Electrical Review" cannot, without attracting some attention, sit astride the fence, and show its fine agility for dropping down whichever side suits it at the moment.

This brings us to the point as to speculating with the ratepayers' money. Here the Electricity Department are proposing to borrow—as a start—no less than £10,000 for motors. But there is no indication as to what rent they are contemplating charging for these motors. There must be assurance that the rent and conditions are such that capital, interest, wear and tear, repair (if the owners' obligation), cost of installation, and all other charges appertaining to the business are included in the rent; otherwise the low price per unit charged for energy for power will never stand anything that is not covered, but should be covered, by the rent. The "Electrical Review" points to the large numbers of gas-cookers that gas undertakings have out on hire; and it takes Norwich as an instance. That is unfortunate, as Norwich is supplied by a Gas Company, with privately subscribed capital. Mr. Ingleby, in his letter to our contemporary, took hold of the point, and said that it had been stated authoritatively before the City Council that the Corporation were now losing thousands of pounds a year on this business. Further, he asserted that it was also vouched for, at a meeting of the Chamber of Trades, that there were thousands of obsolete gas-stoves in the empty houses of Leeds not worth removing, but still figuring on the Corporation books. Now let us tell Mr. Ingleby and the "Review" quite frankly that we do not, without some explanation (which we think would contain important qualification), believe the first statement as to the Corporation losing thousands of pounds a year on the gas-stove business. It must be remembered that gas for cooking purposes is usually supplied at lighting rates and in large measure in the daytime; and there are municipal authorities who—supplying these long-lived gas cooking-stoves free, and furnishing gas for them at lighting rates (largely during daylight hours)—find this a paying business. We can hardly credit, too, that there are in empty houses in Leeds thousands of obsolete gas-stoves not worth removing. Gas cooking-stoves are things that lend themselves to renovation, so long as the body is in condition; and by the time they arrive at the state when the scrap-heap is the proper line of exit, there are few that have not done their duty in producing profit through gas being supplied to them at lighting rates, and not charged for at only (say) one-fifth or one-fourth of the lighting rate. The "Review" and its correspondent have failed to establish any parallel whatever between electric motors and gas cooking-stoves.

It is announced that the Canterbury Corporation Electricity Department has fixed a charge of 4½d. per unit for current supplied to motors used in connection with gas-compressors for lighting purposes. Paltry Canterbury Electricity Department! If a householder wanted current for driving a knife-cleaning machine, the same department would probably meet the requirement at 1½d. per unit, if not less. This is an old question; and it has never yet been fought out, as to the right of discrimination that some electricity suppliers are making between customers who require current for power, by having regard to the purpose for which the power is needed. The purpose has nothing whatever to do with the electricity suppliers, providing the electricity itself is used for obtaining power. It is simply and solely because the power is employed for driving something which is a necessary auxiliary to individual plants for high-pressure gas lighting that preposterous rates are charged for this particular power purpose. There is no other reason; and it is not an edifying sight to see municipal electricity supply departments making themselves look so idiotic by treatment proceeding entirely from jealousy and animosity. The management of more than one undertaking has been made to look very foolish by local derision over similar displays of peevishness. One supply company in London not long since were brought to their senses by a consumer who was supplied at power prices for motors at his business premises, but for motors used for compressing gas, he was charged nearly the top price per unit. This consumer simply altered his accounts to a uniform power price, and for a long time invited the electricity suppliers concerned to take action against him for the balance. But how were they to justify their position? The consumer had also other ways and means of compelling compliance with his reasonable request for uniformity. We cannot understand the childishness existing among business men that prompts such folly as making this discrimination in the purpose to which the power developed through the agency of the electric current is put in order to inflict a high charge where high-pressure gas is concerned. Only the other week in dealing with the Manchester local street lighting *fiasco*, "Meteor" of the "Electrical Times" was talking of charging 8d. per unit for energy used for a motor driving a gas-compressor. What is at the back of all this? It is the growing favour of high-pressure gas lighting, and the electricians cannot deny it.

Gas undertakings are not at all loth, if an electric motor is more suitable for some particular purpose than a gas-engine, to put one in. Quite a large number of gas-works can to-day show moving plant electrically driven—current being, in most cases, cheaply derived from gas-driven generating plants close by. But electricity stations do not to any extent return the compliment and instal gas-engines for driving their generating sets. Rather than have an engine driven by the "enemy," their managers go to the expense of providing storage for oil, to the trouble of purchasing, conveying, and putting the oil into store, and incurring other troubles that are not met with in the patronage of town gas—all because of animosity, and nothing else. Diesel oil-engines are installed. The excuse is that the fuel costs are so low; while the other costs, which are much heavier, are not talked about. There are serious troubles, too, with this form of engine of a nature little met with in connection with other types of engine. Only on the 4th inst. a serious accident occurred at the Guernsey electricity works with a 250-horse power Diesel engine. According to the "Electrical Review," there was a sudden loud explosion, the cylinder cover flew upwards, holes were torn in the roof by the flying masses of metal, which were later found in fragments in the vicinity—parts of the valve gear, for instance, having made an aerial flight of some 20 yards from the building. This reminds of the tragic occurrence at Bray on July 10 last; and of the accident at Maidenhead some two months later. The Diesel oil-engine is fast earning a reputation for very completely accomplishing its purpose when it sets about creating a breach of the peace.

The record of deaths due to electricity continues to lengthen. In the early part of this month, Robert Shannon was working at the Irish Picture Palace Theatre in Dublin, assisting in installing the electric light; and he there met with his death. One of his fellow-workers stated at the inquest that the electric light failed; and

the unfortunate man "went to fix it." He next heard Shannon call out, moan, and then saw him fall back. He did not speak again. From the evidence of the hospital surgeon, it appears that Shannon was dead on his arrival at the institution; and it is an important piece of testimony that the post-mortem examination he made showed that all the organs of deceased were healthy, but there was what appeared to be a slight burn between the shoulders. Death, the hospital surgeon asserted, was due to electric shock. Now comes the important thing from the public point of view. The voltage was only 200, according to the evidence of H. Alward, an Inspector of Electric Installations. We think it a little bit imprudent for men in the position of this inspector of electric installations to publicly make statements that are calculated to cause people to be incautious. A responsibility hangs upon the words of such men. He declared that he had never heard of anyone being killed by a 200-volt current, and added that "so far as I could see, it would be an impossibility for him to get killed by the current that was on." But the man did get killed by the current that was "on;" and there is no getting away from that fact. Commenting upon the recent death in an electric bath with current at 240 volts, the "Electrical Review" refers to this evidence of the Dublin inspector of electrical installations. Our contemporary says: "That ignorance still prevails regarding the danger of a shock from lighting mains is well illustrated by the evidence of an inspector of installations reported in our Notes to-day. He thought it impossible to be killed by a 200-volt shock. Yet readers of the 'Electrical Review' are well aware that several cases have been recorded in our pages where death has resulted from a lower pressure than 200 volts." On Nov. 6, William Henry Pickwell met with his death at the Stuart Street Electricity Station of the Manchester Corporation, through coming in contact with the wires behind the switchboard. But he received a shock of 3000 volts.

We were referring the other day to the question of licences in connection with the manufacture of metallic filament lamps; and it seems rather an expensive process this licence-getting. The Edison and Swan United Electric Light Company are not paying a dividend on the past year's working; and it is explained that there has been a diminution in profits of £6333, which is mainly due to one item of expense being charged against revenue this year "for the first time." This is the payment of royalty under a licence acquired for the use of certain patents in connection with the manufacture of metal filament lamps. The Chairman, at the meeting of shareholders, stated that had it not been for this item, the profits would have more nearly approached, but not quite, those for the previous year. The reasons for the difference are the increase in the price of raw materials, the fact that strikes do not make for economy, and the fresh obligations upon industry in connection with employees. This is precisely what the makers of gas appliances have found.

Just about one-half of the Hove Corporation have the municipalization fever badly upon them. There is one more member in the part that has been attacked than in the part that is just as eager to prevent the other part interfering with a business that is best left to private enterprise. A public meeting of the ratepayers has protested against purchase; and, as we say, the municipalizers on the Council have only a majority of one in their favour. What are the municipalizers proposing to do, if they can get Parliament to sanction the purchase? To obtain a loan of £195,000, and hand over to the Company the capital expended by them—that is to say, £175,000—and receive in exchange the business and the antiquated nineteen-year-old sets at the generating-station. The Council will then be in the position of a corporation who have had an electricity concern for a score of years, and have made no provision for sinking fund or renewals. The capital representing the worn-out plant will be a burden on the concern; and the Council's advisers recommend the spending of £20,000 upon new plant if they purchase. The only question that occurs to the friends of this Hove municipalization scheme is as to the length of time the Local Government Board will allow for the repayment of the purchase loan. It may not be a question for the Local Government Board at all. Parliament is getting into the habit of fixing terms for purchase loans in the Bills that come before it, and to give shorter terms than was their wont in times gone by. If the Hove Council are well-advised, they will let the Electricity Company continue to compete with the Gas Company. Gas companies do not object to fair competition with electricity companies; but they do object to municipal injustice in competition, and to having (as large ratepayers) to bear a big part of the burden when municipal management causes deficits. As that new producer of commercial maxims—A Hugh Seabrook, of St. Marylebone renown—puts it, this is a bit Gilbertian.

Manchester District Institution of Gas Engineers.—We learn from the Hon. Secretary (Mr. W. Whatmough, of Heywood) that the quarterly meeting of the Institution will be held at St. Helens next Saturday, under the presidency of Mr. Samuel Glover, the Gas Engineer and Manager of the Corporation. Three new members will be introduced, and the officers for the ensuing year will be elected. The paper to be submitted for discussion is one by Mr. Henry Kendrick, of Stretford, on "Coal Storage and Coal Fires." Microscopic slides of coal sections will be exhibited by the President. By the kindness of the Gas Committee of the Corporation, the members are invited to visit the gas-works and partake of luncheon in the Town Hall; and the President and Mrs. Glover will entertain them at tea.

LOCAL INCOME AND EXPENDITURE.

The Accounts of Borough Councils.

THERE was issued recently Part V. of the series of Annual Local Taxation Returns, containing the accounts of the councils of boroughs (other than metropolitan boroughs) and those of the urban district councils (other than town councils), for the twelve months ending March 31, 1911. Occasion may now be taken to refer to some of the figures in this Blue-Book which relate to the borough councils; the finances of the urban district councils being left for notice in another issue.

The number of boroughs in existence at the end of the year 1910-11, excluding the City of London and the Metropolitan boroughs constituted under the provisions of the London Government Act, 1899, was 325; and out of this total 74 were county boroughs. The receipts (including transfers from one account to another), other than from loans, of the borough councils for the period now under review—not being the Exchequer contribution accounts of county boroughs, nor the accounts relating to tramway, light railway, or water, gas, or electricity supply undertakings—amounted, in the aggregate, to £36,021,596, or deducting items of receipts from other accounts of the same councils, to £32,659,983. Of the former sum, £20,558,835 was from rates; £28,017 was from grants under the Agricultural Rates Act, 1896; £1,174,286 sums transferred in relief of rates from accounts relating to tramways and light railways, and water, gas, and electricity undertakings; and £6,119,477 on account of education. The expenditure (exclusive of that defrayed out of loans, and of Exchequer contribution accounts and accounts relating to tramway and light railway, and water, gas, or electricity undertakings), including money passing from one account to another of the same corporation, amounted to £36,215,922, including £11,355,870 spent on account of education. Some of the principal items on this side (including loan charges) were: Public roads and streets, £5,265,100; sewerage and sewage disposal, £2,424,883; public lighting, £1,266,173; salaries, &c., and certain establishment charges, £1,529,388. There were also amounts transferred to make up deficiencies in the revenue of tramways, light railways, and water, gas, and electricity works, totalling £393,398.

The expenditure which was charged during the year by the councils, or was intended ultimately to be charged, to loan accounts, excluding the expenditure in respect of tramway, light railway, and water, gas, and electricity supply undertakings, was £4,063,126. The individual headings are: Education, public offices and buildings, lunatic asylums; bridges and ferries; public libraries, museums, &c.; burial grounds; harbours, piers, &c.; public roads and streets; sewerage and sewage disposal works; markets; housing of the working classes; parks and open spaces; and other purposes. The total amount of loans that were actually raised during the year, excluding tramway, light railway, and water, gas, and electricity undertakings, and money borrowed under the Education (Provision of Working Balances) Act, 1903, was £4,764,962. The amount outstanding at the close of the year 1910-11 in respect of loans owing by councils (excluding tramway, &c., undertakings, but including education) was £128,965,200. Of this £28,087,065 was for public roads and streets, £21,286,259 for sewerage and sewage disposal works, and £20,797,739 for education. The sums standing to the credit of sinking funds, loan funds, and redemption funds in connection with such of the outstanding loans of the councils as were repayable by means of such funds, amounted at the close of the year to £9,070,451 in the case of county boroughs, and to £1,694,845 for the non-county boroughs concerned.

On turning to the tables with regard to the accounts of councils connected with the undertakings that were not included in the figures already quoted—namely, the tramway, light railway, and water, gas, and electricity concerns—it is noticed that the receipts for the year 1910-11 (excluding sums withdrawn from reserve, &c., funds, and sums transferred from other accounts to make up deficiencies in revenue), other than from loans, and the expenditure not defrayed out of loans, were as follows: Tramways and light railways—Receipts, including £46,941 received from other accounts of the councils, £6,420,699; expenditure, including loan charges, £6,059,905. Water undertakings—Receipts, including £197,234 received from other accounts of councils, £4,457,081; and expenditure, including loan charges, £4,544,060. Gas undertakings—Receipts, including £542,514 received from other accounts of councils, £7,312,716; and expenditure, including loan charges, £6,681,845. Electricity undertakings—Receipts, including £1,163,962 received from other accounts of the councils, £4,107,034; and expenditure, including loan charges, £3,811,038. This gives a total income for the four classes of undertakings of £22,297,530, and an expenditure of £21,096,848. The expenditure, it should be remarked, excludes sums paid to reserve, &c., funds, and amounts transferred in relief of rates, or to meet deficiencies in revenue and other undertakings; but expenditure out of sums withdrawn from reserve, &c., is included.

With reference to loans, the total amounts expended by the councils (or intended ultimately to be charged to loan account), and the total amount raised during the year 1910-11 for the purposes of the various classes of undertakings now under review, were: Tramways and light railways—Expenditure out of loans, £353,714; and receipts from loans, £687,217. Water-works under-

takings—Expenditure, £1,405,703; and receipts, £1,530,730. Gas undertakings—Expenditure, £246,433; and receipts, £242,197. Electricity supply (including indistinguishable items for public electric lighting)—Expenditure, £826,606; and receipts, £948,490. Thus the total expenditure out of loans was £2,832,456; while the receipts amounted to £3,408,634. The loans outstanding at the end of the year under review were: Tramways and light railways, £22,568,895; water undertakings, £63,168,694 (in addition, a sum of £12,065 was due at the end of the year to capital funds of the councils in respect of money appropriated in lieu of borrowing); gas undertakings, £19,217,134; and electricity supply (including indistinguishable items in respect of public electric lighting), £21,509,680 (in addition, a sum of £25,882 remained due at the end of the year to the capital funds of councils in respect of money appropriated in lieu of borrowing). These amounts made a total of £126,464,403 outstanding in the shape of loans. The sum remaining in sinking funds, loan funds, and redemption funds at the end of the year, to provide for the repayment of the outstanding loan debt, was £7,828,980. The reserve, depreciation, and insurance funds established in connection with various undertakings dealt with in the returns amounted at March 31, 1911, to £5,046,352.

According to the preliminary report on the Census of 1911, the total population of the 74 county boroughs was 10,818,716, and that of the 251 other boroughs 4,689,406—making an aggregate of 15,508,122. The aggregate assessable value on April 1, 1910, for the purposes of borough rates, was £72,482,077. The rates raised during the year by councils of county boroughs averaged 5s. 9·8d. in the pound. In the case of the non-county boroughs, the average was 3s. 9·1d. in the pound where the councils were not the local education authorities, and 4s. 9·1d. where they were. The total amount raised was: In county boroughs, £15,520,798; in non-county boroughs, £5,018,958.

It has been stated already that the total transfers from the accounts of tramway, light railway, and water, gas, and electricity undertakings in aid of rates, for the twelve months ending March 31, 1911, amounted to £1,174,286; while there were aggregate transfers from borough, district, or other funds to make up deficiencies in the revenue of such concerns to the extent of £393,398. The former amount was made up as follows: Tramways and light railways, £359,158; water undertakings, £136,851; gas undertakings, £526,018; and electricity supply, £152,259. The deficiencies which had to be made good were: Tramways and light railways, £92,593; water undertakings, £268,298; gas undertakings, £1068; and electricity supply, £31,439. As usual, the largest amount of profit distributed in relief of rates came from gas undertakings, as well as the smallest sum under the heading of amounts transferred from other accounts to make up deficiencies in revenue.

If one analyzes the section of the returns dealing with this matter, it is seen that of the gas-works profits transferred in aid of rates for the twelve months now under review, the amounts of £10,000 or over were: Birkenhead, £12,547; Birmingham, £75,498; Blackpool, £11,810; Bolton, £20,000; Burnley, £13,550; Halifax, £10,973; Leeds, £17,961; Leicester, £35,727; Manchester, £46,500; Nottingham, £35,000; Salford, £15,750; Southport, £13,000; Stockport, £18,000; and Warrington, £12,363. From electric lighting undertakings, there are the following cases of transfers of £10,000 or upwards: Birmingham, £10,256; Liverpool, £25,000; Manchester, £15,000; and Nottingham, £16,700. In regard to water-works, the cases of transfers of £10,000 or more are: Bradford, £10,800; Kingston-upon-Hull, £12,000; Leeds, £15,569; and Oxford, £11,936. All the amounts named relate to undertakings owned by the county boroughs. Among the non-county boroughs, the Wallasey gas undertaking handed over £11,554 in aid of the rates.

Turning for a moment to the other side of the accounts, where the losses are set forth, and taking first the case of gas, it is found that, out of the 104 gas undertakings controlled by borough councils, there are very few cases in which it has been necessary to transfer amounts from other funds to meet deficiencies in revenue. Under Liverpool, for the portion of the area which the Corporation have in their hands, there appears the sum of £179; the other instances being Sandwich £300, Wenlock (part) £189, and Pontefract £500. As to electricity, out of the 151 undertakings owned by the borough councils, deficiencies have had to be met in about twenty-five instances. Among the largest amounts were Dudley £1000, Hastings £2919, Worcester £1322, York, £3394, Whitehaven £1238, Hereford £1000, Faversham £1348, Gillingham £4379, Morecambe £3054, Loughborough £1500, Kingston-upon-Thames £1644, Brighouse £1730, and Todmorden £1549 (nearly all to meet capital expenditure in lieu of raising a loan). In connection with water-works, there are a good many instances of deficiencies which had to be met; but often the sums involved were comparatively small. The cases in which the deficiencies exceeded £10,000 are: Birmingham, £69,823; Halifax, £12,631; Huddersfield, £17,155; Southport, £11,289; and Swansea, £35,638.

Mr. John Leslie Cloudsley, of Brightlands, Reigate, for many years a Director of Messrs. Parkinson and W. & B. Cowan, Limited, whose death on the 18th of September was noticed in the "JOURNAL" at the time, left estate of the gross value of £60,795, of which £58,483 is net personalty.

WAGES AND HOURS OF LABOUR IN 1911.

IN presenting the nineteenth annual report of the Labour Department of the Board of Trade on Changes in Rates of Wages and Hours of Labour, Mr. G. S. Barnes remarks that the outstanding feature of the year 1911 (the period dealt with) was an increase in wages in the transport group of trades. The aggregate increase in the wages bill resulting from this is not yet known, as complete statistics are not available; but from the information given in the report, it is evident that it greatly outweighs the net advance in all the other industries, which amounted to about £18,500 per week, spread over the 800,000 workpeople affected. The upward movement in the non-transport trades, he adds, continued throughout 1911, and has become much more rapid during recent months.

The report, it may be mentioned, deals with the changes in the rates of wages of workpeople in the United Kingdom for a full week's work, exclusive of overtime, and with the changes in their recognized normal hours of labour. A "change in wages" is defined as a change in the rate of remuneration of a certain class of workpeople, apart from any change in the nature of the work performed. Reference is not made to changes in average earnings arising out of variations in the extent of employment obtainable by workpeople. The department received returns from employers and Employers' Associations, Trade Unions, its own correspondents, and other sources; and the daily and trade papers were consulted for references to any movements in wages or hours. Changes affecting less than five workpeople are not included in the statistics. It is pointed out in the report that the slight upward movement in wages which commenced in 1910 was maintained on the whole during 1911; but though the changes in the second half of the year showed a stronger upward tendency than those of the first half, the movement did not at any time become very marked. At the end of 1911, however, the general level of wages was higher than at the end of any year since 1893—except 1907 and 1908.

The number of workpeople reported to the Department as affected by changes in wages during 1911 was 916,366. Agricultural labourers, seamen, and railway servants are not included, as the numbers affected are not known. Increases amounting to £46,247 were received by 507,207 persons; while 399,362 sustained decreases totalling £11,669 per week. The remaining 9797 had upward and downward changes which left their wages at the same level at the end as at the beginning of the year. The net result of all the changes was thus an increase of £34,578 per week. In 1910, changes affecting 548,938 workpeople resulted in a net increase of £14,534 a week. The mean percentage of trade union members unemployed in 1911, so far as reported to the Board of Trade was 3, compared with 4·7 the previous year. For the purposes of the return, the different trades are placed in seventeen groups; and in all but mining and pig iron manufacture there were net increases in wages during the period under review. The proportion of the industrial population (with the exceptions already named) affected by ascertained changes in rates of wages in 1911 was 9·3 per cent.; the proportion of workpeople affected by the changes being, as usual, highest in the coal mining industry—37·8 per cent. In connection with coal mining, the 390,793 workpeople affected sustained a net reduction of £9553 per week in their wages. The changes in the past sixteen years, however, as might be expected, show a net increase in every group of trades dealt with. Over this period, coal mining accounts for an increase of £158,420, or nearly one-half of the total amount; while the building, engineering and shipbuilding, and textile trades together account for £135,866, or about one-third of the total.

Of the 390,793 workpeople in the coal-mining industry whose wages during 1911 resulted in a net decrease of £9553 per week, 368,650 were employed in Northumberland, Durham, South Wales, and Monmouthshire, in each of which districts wages fell. In the Federated Districts (comprising Yorkshire, Lancashire, Cheshire, Nottinghamshire, Derbyshire, Leicestershire, Warwickshire, Shropshire, parts of Staffordshire, and North Wales) and Scotland no changes took place. An increase occurred in the Forest of Dean; while in the Bristol and Radstock districts the hewers received net increases. In all cases, wages were higher at the end of 1911 than sixteen years ago; but, with the exception of the Federated Districts, South Staffordshire, East Worcestershire, and Bristol, they were below the high level attained in 1900. In the areas named, wages stood at the same level as at the end of 1900. The number of workpeople affected in the quarrying industry was 6914; the net amount of the changes being an increase of £199 per week.

The number of workpeople affected by changes in wages last year in the metal, engineering, and shipbuilding trades was 278,953; and the result was a net increase of £18,642 per week. In the previous year, 97,343 persons received a net increase of £4732 per week. Among the more important changes in the engineering trade were increases to large numbers of men on the North-East Coast, Scotland, Birmingham and district, Leeds and district, and Lancashire. Employment in the engineering trade was good in 1911; the mean percentage of trade union members unemployed being 3·2, as compared with 5·8 in 1910, and 11·6 in 1909. In the shipbuilding industry also employment was good; the percentage of men unemployed (4·3) being lower than in any year since 1901. As to the textile group of trades, the changes in rates of wages last year affected 19,351 workpeople, and resulted

in an increase of £1094 per week—all the changes reported being increases.

Turning to the tables which set forth the details, it is noticed that 5846 gas workers in company employ received a total weekly rise in wages amounting to £639; while 146 were affected by decreases which totalled £27. At Hull, gas workers received an increase of 2s. per week on rates of 25s. and under, and 1s. on rates over 25s. At Ipswich, the labourers in the gas-works were advanced ½d. per hour, to 5d.; and one London Company gave their workers an average rise of 2s. 10d. per week. The stokers at Longwood received 2d. more per shift, making the figure 5s. 6d. There were various advances at Sheffield—amounting to 3d. to 9d. per shift, and from 1s. to 4s. per week; and at Sunderland the stokers, yard labourers, &c., were granted 1s. to 1s. 3d. per week more. Increases made at Swansea were 3d. per day (making 5s. 4d.) to stokers, and 6d. per week (making 24s. 6d.) to lamplighters. Rises of 1s. and 1s. 3d. per week at Tynemouth brought the wages of plumbers and gas-fitters up to 34s. per week, labourers to 25s. 6d., and firemen to 43s. 9d. An increase of 3d. per shift to the York gas stokers makes their wages 5s. 3d.; while an additional 4s. per week to Sligo stokers gives them a wage of 25s. and 27s.

Employees of local authorities are dealt with in a section of their own; and running through this, the following increases of gas-workers' wages are found recorded: Stockton-on-Tees—smiths, fitters, and turners, 1s. per week. Beverley—stokers, 2s. 6d. per week, to 37s. 6d.; and other men, 2s. Bradford—stokers, 2d. per shift, to 5s. 6d. Goole—stokers, labourers, &c., 1s. to 2s. per week, or ½d. per hour, making 36s. 9d. for stokers and 23s. for labourers. Huddersfield—labourers, 1s. per week, to 25s. Birkenhead—stokers, 3d. per shift, to 5s. 3d. Wallasey—stokers, 4d. per shift on week days, and 6d. per shift on Sundays, making 5s. 4d. per shift on week days, and 8s. per shift on Sundays. Bristol—lamplighters, 1s. per week, to 23s. to 25s. Coventry—stokers, 3d. per shift, to 4s. 9d. to 5s. 6d.; labourers, ½d. per hour, to 6d.; and retort-scurfers, change from a rate of 6d. per hour to 5s. per shift. Leicester—employees, 6d. to 3s. per week. Dundee—employees, from 1s. to 2s. 6d. per week. Glasgow—stair lamplighters, 1s. to 2s. per week, to 19s. and 20s. Renfrew—stokers, 5d. and 2d. per shift, to 4s., 4s. 8d., and 5s.

Glancing in conclusion at the portion of the report which relates to changes in hours of labour, it is seen that in 1911 there were 155,407 persons affected in this respect; the net result being a reduction of 715,459 hours in their weekly working time. The changes recorded, however, do not include temporary alterations in working hours owing to changes in the state of trade or regularly recurring seasonal alterations. A table covering the past ten years shows that there has been a net reduction in recognized normal working hours during each year of this period. With the exception of two years, when the changes were the result of legislation, the figures for 1911 are by far the highest of any in the table. Important reductions in working hours as affecting transport workers and printing trade operatives are largely responsible for this state of affairs. At Sheffield, 841 gas-works employees had their working time decreased by 1 hour per week, making the time 53 hours; and at Coventry the retort-scurfers had theirs reduced 3 hours, making a 48-hour week.

PRIVATE OWNERSHIP AND RESTRICTED SUPPLIES.

In discussing the "London Traffic Trust" last week, the "Daily Chronicle" made some charges against the privately owned gas companies which, in these days, it would be very difficult to substantiate. Speaking of the "Trust" cheapening its transit fares to enable it to get large returns, the newspaper in question remarked:

> "It may be that the Trust must keep down fares in order to get the maximum returns; but a long experience of gas companies, water companies, and other privately owned monopolies, shows that this is not so, and that private monopolies always tend to favour a restricted supply at excessive prices unless they are compelled to do otherwise in the public interest."

There are two very definite statements in the article in question (one might almost call them charges) that cannot be allowed to go unchallenged—viz., the reference to the "restricted supply" and "excessive prices." Any silence on our part would be an acquiescence in the statement made. Speaking for the privately owned gas companies of the United Kingdom, it would be the easiest task imaginable to refute such a charge against the gas industry. The very reverse is the case. The gas companies of the country, both large and small, are striving by might and main to accomplish the dual task of increasing the output and cheapening the price of gas—in fact, they are endeavouring, by every legitimate, scientific, and engineering effort within their power, to reduce (and they have reduced) the price of gas per 1000 cubic feet to their consumers, in addition to which they have enormously increased the output.

One has only to look at the prices obtained for gas in the Metropolis in years gone by, and compare them with those current to-day of some of the companies having the largest areas. Our contemporary is usually fairly well informed, and for this reason we are sorry that either bias or want of knowledge of the subject should have led it so far astray. What will the writer of the article in question say when we inform him that the price of gas at the time it was first sold to the public by meter was 15s. per 1000 cubic feet, while to-day the Gaslight and Coke Company, who operate in 121 square miles of territory (against 10 acres at the commencement of their career), and are therefore, we may presume, one of the "privately owned monopolies" referred to, have reduced the selling price of their gas from that figure—viz., 15s.—to 2s. 6d. per 1000 cubic feet to private consumers and to 2s. 2d. for public lighting. The Commercial Gas Company, another Metropolitan Company, are also selling at 2s. 6d. per 1000 cubic feet; while the South Metropolitan Company—the pioneer of cheap gas supply—are selling at 2s. 2d. per 1000 cubic feet. They had, however, been selling at 2s. prior to the abnormal rise in coal prices. The Wandsworth and Putney Gas Company are selling gas as low as 1s. 9d. per 1000 cubic feet. Beyond this, with a view to increase the output—not to "restrict supply by excessive prices"—the Companies, in addition to these low rates charged, give substantial discounts to large consumers, users of machinery, and gas-engines (according to scale). There is therefore an incentive on the part of the consumer to use the Companies' gas for heat, power, &c., to obtain the increased discounts.

All this shows that there is no restriction or desire on the part of the Companies to restrict the supply—in fact, the returns read at the half-yearly meetings show compound increases of as much as 7 and 10 per cent. on the outputs of some of the large Companies operating in the neighbourhood of London. The increases are greatly accounted for by the extending uses to which gas is put by the working classes and the suburban dwellers—the very classes of whom, we imagine, the writer espouses the cause.

Let us give one concrete example as to the unrestricted supply afforded by the Gaslight and Coke Company. In their earliest years they carbonized about 4000 tons of coal per annum; while at the present time the rate is equivalent to an annual consumption of 2¼ million tons. Again, to show that there is really no "restricted supply," the following table, giving the increased output of the Company during the last five decades, should prove not only interesting but conclusive:—

	Cubic Feet.
1871	3,183,777,000
1881	12,169,636,000
1891	19,232,716,000
1901	21,160,142,000
1911	25,484,985,000

These figures, taken together with a reduction in price of 5d. during the last five years, show an increase in supply and a gradual but continuous cheapening of price that have gone hand-in-hand for years past.

A further interesting fact, showing how the gas companies have the interest of their consumers at heart, is shown when we remind our contemporary that a reduction of 1d. per 1000 cubic feet of gas (small as it may appear) equals, in the area of the Gaslight and Coke Company (North of the Thames), a sum of no less than £100,000. Nearly the whole of this goes to the consumer—only about one-eighth of the penny, we believe, going to the shareholder. The Company, having taken 1d. off the selling price for five consecutive years, and reduced the price from 2s. 11d. to 2s. 6d., have given to the consumers a sum amounting to nearly half-a-million sterling; and while they have been able to do this, they have at the same time been redeeming obsolete capital at the rate of £30,000 per annum out of divisible profits before declaring any dividend for the shareholders. This action, again, will tend ultimately to further cheapen the price of gas. At the same time, the Company look after the interests of their 9000 employees who are co-partners and shareholders in the concern.

Before leaving this subject, we would state most clearly and emphatically that there is every incentive for the leaders of the gas industry, whether of municipally controlled or privately owned concerns, to cheapen the price and remove any restrictions as to supply; and all—co-partners, shareholders, and directors, from the man on the district to the chairman at the board—are working together to-day in the interest of the consumer, to afford him a cheap and unrestricted supply of light, heat, and power to enable him to carry on his industrial pursuits, heat his dwelling and public buildings, cook his meals, and light his home and his streets.

Obituary.

Mr. William Ballantyne, who was a Director of the Coatbridge Gas Company, died at his residence Hinterlee, Coatbridge, on Tuesday last.

The death occurred last Saturday morning, in his eighty-second year, of Mr. Thomas Layton, who was for thirty years Secretary and Manager of the Redditch Gas Company—a position he relinquished in 1903. One of his sons (Mr. A. E. Layton) is the present Engineer and Secretary of the Company; and another (Mr. Walter T. Layton) is in the service of the South Metropolitan Gas Company, and the Editor of their "Co-Partnership Journal."

The Midland Junior Gas Association announce that a smoking concert will be held in the City of Birmingham Gas Department Recreation Room, Devon Street, on the 7th prox. An excellent programme has, the Hon. Secretary (Mr. W. J. Pickering) states, been arranged.

COAL-CONVEYING PLANT AT THE LEIPZIG GAS-WORKS.

By Hubert Hermanns, Engineer, of Duisburg.

The former provision at the Leipzig Corporation Gas-Works for the transport of coal, which was effected by hand, being no longer such as fulfilled the requirements of the present day, it became necessary to undertake a thorough reconstruction of the plant. The execution of the plans therefor was put in the hands of the firm of Unruh and Liebig, of Plagwitz, Leipzig.

The existing coal-sheds, as will be seen from the plan (fig. 1), form a triangle of which the apex has been cut off; and it was necessary to equip them with mechanical conveying plant. Further, apparatus had to be provided for unloading coal by machinery, passing it through breaking plant, and either putting it into store or, on the other hand, conveying it to the retort-house and emptying it into elevated bunkers. The quantity of coal to be dealt with was 60 tons per hour. The coal-sheds, triangular in plan, consist of nine separate sheds, each 39·4 feet wide, and 49·2 to 180·5 feet in length. One of the side sheds, however, was intended for use as a power station and the other as a locomotive shed; while a portion of the middle shed was cut off from it and built up to a greater height. The contracting firm satisfactorily dealt with the problem thus presented in the manner to be now described.

The transporting plant is disposed in the following order: The railway waggons, loaded with coal, are emptied by a waggon-tipper into a receiver beneath the floor. This receiver is provided with two elevators, which raise the coal to the third floor of the coal-station. The coal intended for immediate carbonization is delivered to the retort-house by two band-conveyors, which deposit it there in a number of overhead bunkers. The coal which has to be shot in the store is taken by an electric telpher line, of which the tracks traverse the whole length of each coal-shed, as shown in fig. 1, and is distributed over the store. As required, the coal is removed from the store by being shovelled into telpher skips with hoisting gear, which travel on the same line to the coal-station, where the skips are emptied into the funnel shoot of the breaker. It will be of interest to describe in detail the mechanical equipment and apparatus provided, and thus afford a fair impression of the whole plant.

The tipper for discharging the railway waggons is shown in fig. 2. It is worked by two hydraulic pumps, which raise the back part of the platform of the tipper by means of a plunger. The end door of the waggon is then opened to allow its contents to slide out. The two pumps are driven by the same motor, which works on a connecting shaft. The arrangement of two pumps serves on the one hand to secure very quick tipping of the waggon, and on the other hand to leave an adequate reserve available should one pump get out of order. In the design of the whole conveying plant, particular attention has been given to the provision of sufficient reserve for all plant and apparatus, in order to avoid trouble in case of a breakdown of the mechanical parts.

The coal tipped from the railway waggons falls into a funnel-shaped underground masonry tank, which is covered by a wrought-iron grille with 16-inch openings. Large lumps of coal, which do not pass through the openings in the grille, are broken by hand on it. The bottom flanges of the funnel-shaped tank are formed into two feeding devices, from which two bucket elevators, placed one alongside the other, are fed. They raise the coal at

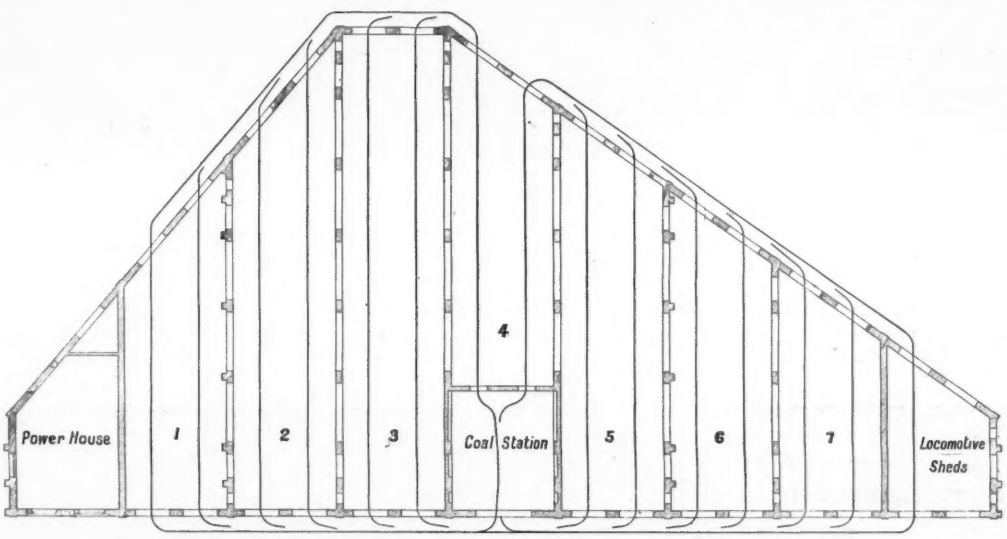


Fig. 1.—The Coal Stores and Telpher Lines at the Leipzig Gas-Works.

an angle, and are driven by an electro-motor working through a double intermediate belt-gearing on a shaft with toothed gearing, which in turn actuates the driving shaft of the elevator. The elevator consists of buckets, 32 inches wide and 16 inches deep, which run on rollers and form an endless series of buckets, in accordance with the large carrying capacity which the elevators are required to have.

All the coal coming to the works is discharged by the tip, and raised by the elevators. At the delivery point of the elevators, there are two conveyors, which convey the coal either directly into the retort-house for immediate use or into the coal-store. In the former case, the procedure adopted is that the coal passes into two toothed-breakers after it has passed over a swing screen, as shown in fig. 3. The screen removes the small coal, which need not pass through the breaker. From the breaker the coal falls on to two bucket elevators, which convey it to two automatic weighing machines, by which the weight of the coal arriving for carbonization is ascertained with precision. The coal from the weighing machines is fed by two special feeders on to two band-conveyors, which connect the coal-loading station with the retort-house. The two band-conveyors run on a high bridge, on which they are protected from the weather by a corrugated iron roof and sides. The bridge spans the space for the railway waggon sidings between the coal-sheds and the retort-house, and does not interfere with the shunting of the waggons. The band-conveyors are one on each side of the bridge; a free passage being left between them for carrying out repairs and lubricating the moving parts. The gear by which the conveyors are driven is on an elevated platform above the band-conveyors.

The two conveying bands pass into the centre of the retort-house a little below the roof-framing. Running transversely beneath them are four more conveying bands, which extend over two series of elevated bunkers, capable of containing in all 360 tons of coal, and connected with one another by bridges. The coal distributing station is placed in the middle between the conveying bands, which serve to distribute it, and is equipped in such a manner that any one of the band-conveyors in the retort-house can be loaded from either of the band-conveyors bringing coal from the coal-sheds. This arrangement is specially noteworthy because any one of the conveyors will serve as a reserve in place of another. Thus interruptions of work are guarded against to the greatest possible extent. The interior band-conveyors are driven in pairs by one electro-motor for each pair.

The coal is discharged from the distributing conveyors by means of a travelling discharging trolley, which, driven by the conveyor itself, moves to and fro between two projections over the bunkers, and thereby affords uniform filling of the bunkers. The discharging trolley for the band-conveyors consists, in its simplest form, of two rollers set in a frame one above the other, and placed lengthwise across the band and the sheet-iron discharging shoots, which extend on both sides above the band. The band passes S-wise over the two rollers, and as it goes over the upper roller discharges its load into the discharging shoots. For the travelling discharging trolleys, the trolley is provided with rollers which run on a rail. The travelling trolley may then be operated either by hand by means of a winch, or through the band itself, which, in that case, transmits its motion to the rollers by means of a small friction-gearing. With completely automatic working, the discharging trolley at the end of its travel runs against a projection on the rail, which releases the driving-gear and allows the trolley to return. The elevated coal-bunkers are provided with a number of rotating valves by means of which the coal is removed into the retort-charging machines.

A different method of working is adopted if the coal on arrival, after being discharged by the waggon-tip, is not directly taken to the retort-house, but is put into store. The coal-sheds in which

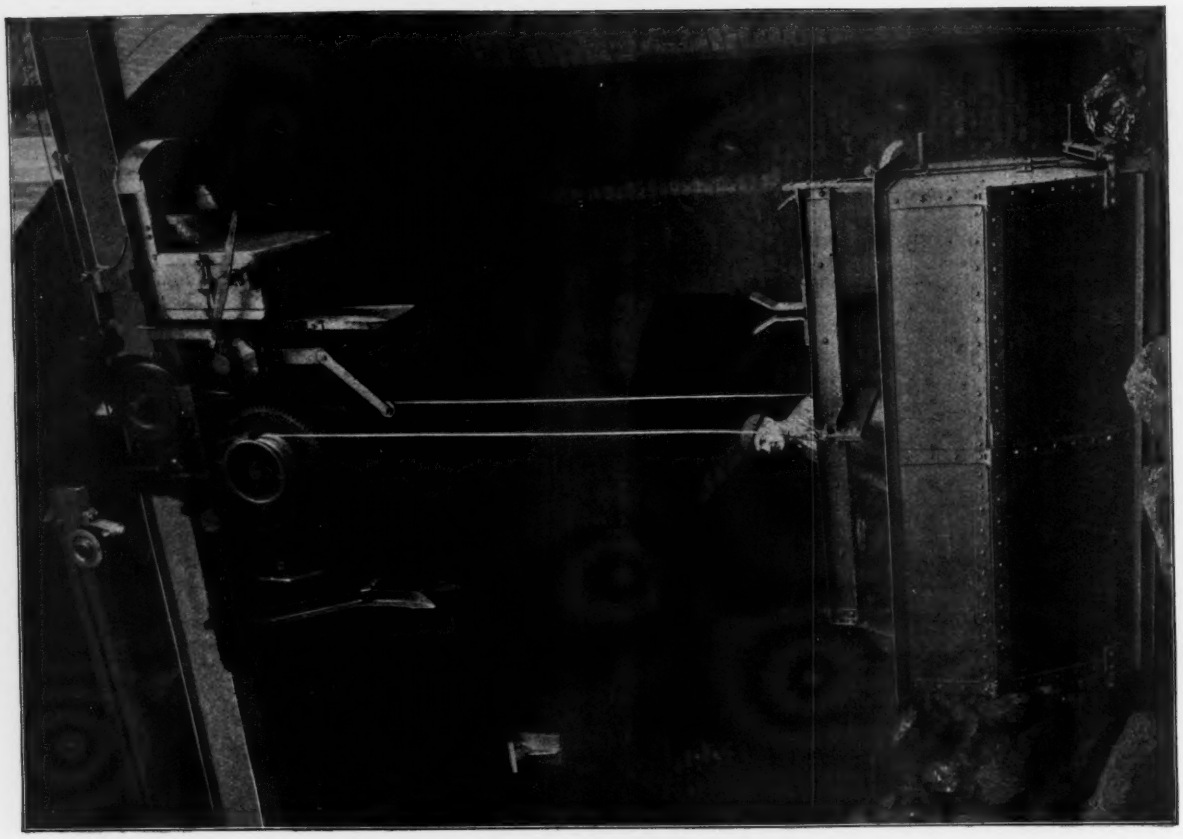


Fig. 3.—The Loading of the Telpher Skips.

Fig. 2.—Hydraulic Tipper for Discharging the Railway Waggons.

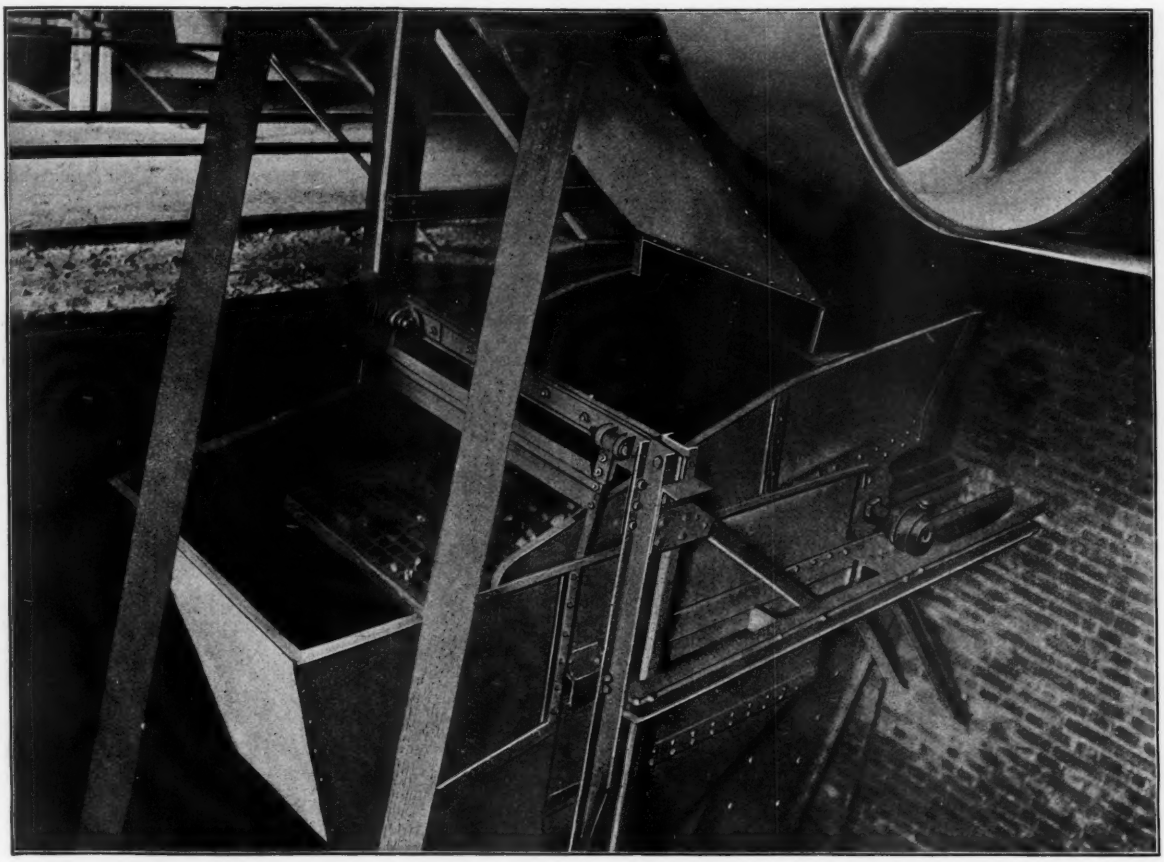


Fig. 3.—The Swinging Screen above the Coal Breakers.

such coal is stored are filled, as already explained, by means of an electric telpher line. The course of this line is shown in fig. 1. The travelling skips pass from the loading station round the outside of the coal-stores on a track at a height corresponding with the height of the various openings in the store-sheds. Two circuits of rails are thus formed which run parallel to one another through the middle or No. 4 shed (in which is the receiving station), and are there connected with one another by a switch. At the openings into the sheds, the outer circuit of rail has branches entering the sheds, and switches which are set by hand. Two rails run parallel to one another through each shed, and connect at the other end of the shed with the outer circuit-rail, by which the skips are returned to the loading-station. This arrangement affords a closed circuit from the central loading station

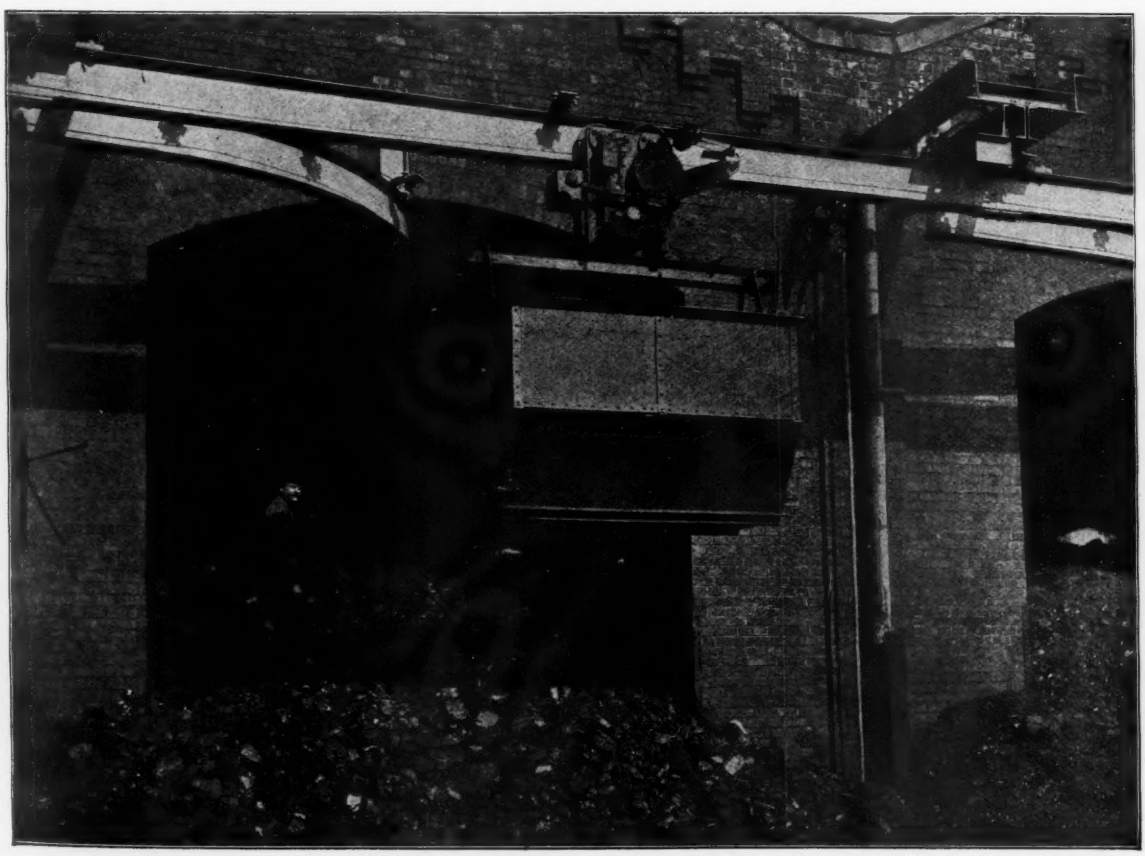


Fig. 4.—The Self-Emptying Telpher Skip.

through each shed, whereby each shed may be completely filled with coal.

The telpher, shown in fig. 4, consists of a travelling skip having laterally opening doors at the bottom (kept closed by a lever) and travelling gear. The skip hangs on a traverse. The travelling gear consists of an underhung travelling frame, and is driven by a small electro-motor fed with current from a conductor which runs alongside the track. The skip holds 1·4 tons of coal, and is discharged automatically by the lever, which keeps the bottom flaps of the skip closed, striking against a stop. The stop is attached to a trolley, which travels on a girder alongside the telpher-line. The contents of the skip are discharged while it is travelling, through the opening of the bottom flaps. The trolley with the discharging stop can be placed at any point, by means of a chain and chain-wheel at the entrance of each shed.

The transport of coal is, in practice, dealt with in this manner:

First the switches are shifted to correspond with the section of the store-sheds which has to be filled with coal. Then the telpher skips are filled with coal from the receivers of the unbroken coal-elevators, and are set in motion by switching on the current. The discharging stop trolley is next run to the place where the skip is to be discharged. When the skip on its journey strikes against the discharging-stop, the flaps of the skip are opened and the contents drop out, while the skip continues (with the flaps open) to travel to the loading-station, where it runs on to a track not supplied with current and comes to rest there. A workman then closes the flaps of the skip, and moves it to the back of the loading-ramp, where it is filled with coal. By closing the switch, the skip is again started on its way to the sheds. The manual work is, therefore, limited to the closing of the flaps, the shifting of the points, and the setting of the discharging-stop trolley. The rest of the work is carried out automatically. The coal which piles up on top in the store must, however, be occasionally spread out.

The same line is used for conveying the coal again from the store; but as it is too high for the skips which are used for filling the store to be loaded from below, telpher-cars are employed, from which the skips may be lowered on to the coal. The travelling frame has, therefore, to be provided with a hoisting device, which is driven by an electro-motor in order to carry out the work as quickly as possible. The suspended skip and travelling frame are shown in fig. 5. The skip holds a ton of coal. It is of the same type as the skip used for bringing the coal into store; but the travelling-car naturally differs considerably from that of the latter. In addition to the propelling motor, there is also the hoisting motor, the axis of which lies in the direction of travel. This motor drives, by means of worm-gearing, a toothed-wheel on the axis of the two hoisting-drums. In order to prevent the skip swinging either sideways or in the line of travel while it is travelling, special guides of angle-iron are provided on the telpher; and so as to limit the hoist a cut-out of the hoisting mechanism is provided

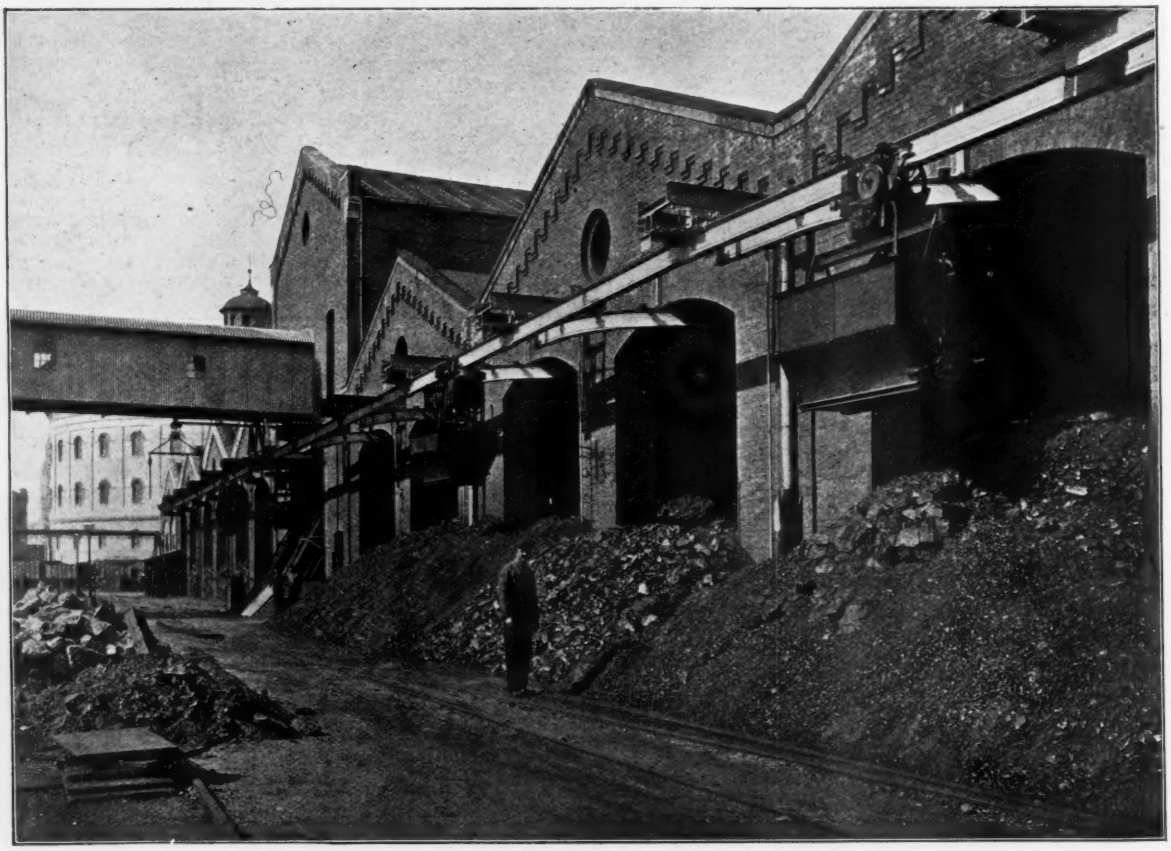


Fig. 6.—General Arrangement of the Telpher Coal Plant.

by which, when the skip has reached its maximum height, the hoisting motor is automatically switched off, and the propelling motor is simultaneously set in action.

The stop trolley employed with this telpher car is of quite different construction from the discharging-stop trolley already described, out of consideration of the different work which it has to do. It is not in this case a question of releasing the closed flaps of the skip, but of bringing the cars automatically to rest at the places where they have to be loaded, and of lowering the skips. For this purpose, the stop trolley is provided with a rail which forces the contact-drum away from the electrical conductor, and the car consequently comes to rest. Further, the stop trolley is equipped with a long draw-rope, which operates a control-slide on it. By the aid of this slide, the skip is lowered to the coal; but the lowering motion lasts only as long as contact is made, and can be arrested at any desired point. This arrangement is of special value, because the height to which the coal is heaped is very different at different places. It is, therefore, essential to interrupt the lowering of the skip sometimes sooner and sometimes later. After the conveying skip has been filled by hand shovelling, the slide is again brought into action through the draw-rope until the conveying skip reaches its highest position, when it is arrested. The propelling motor is then automatically switched on. The stop-trolley is brought into position as already described—by a draw-chain with wheel, from the opening of each shed.

The conveying (after reloading) of the coal brought into store takes place in this manner:

The empty cars pass, according to the setting of the points, into any one of the sheds, and are there stopped by the stop-trolley, and lowered by means of the control-slide operated by the draw-rope. After the conveying skips have been filled with coal, there follow (in the reverse order already mentioned) the raising of the skips and their outward passage through the automatic switching-in of the propelling motor. The cars then travel to the coal distributing station, and so to the bunker over the breakers, the flaps of which are reversed. The telpher car arriving over the bunker, on the releasing lever of the flaps of the skip being raised, discharges the coal into the breaker. The breaking is finished while the skip travels back; and no attendant is required at this point. The travelling skip returns to the coal-sheds, where the workman again closes the bottom doors and fills it again. The loading of the skips is the only manual work.

Fig. 6 shows the front wall of the coal-store with three cars on the telpher track. It also gives a general idea of the disposition of the plant, with the raised middle section of the shed in which are the coal distributing and loading station, and the bridge connecting the coal-store with the retort-house.

In conclusion, the author desires to record his thanks to the firm of Unruh and Liebig for their kindness in affording him information and the illustrations for this article.

LIGHT: ITS USE AND MISUSE.

A Primer of Illumination Prepared Under the Direction of the Illuminating Engineering Society of America.

[See, p. 649.]

It is the purpose of this publication to assist the user in making artificial light effective, whether the light be produced by oil, gas, electricity, or otherwise.

By proper use, you can get good illumination from any of these sources, but by misuse you are likely to get lighting that is bad, costly, and even dangerous to the eyesight.

Illumination and Comfortable Vision.

To see easily and comfortably, you must select the lamps, fixtures, and globes and arrange the lights so as to best suit the particular conditions which have to be met. But certain principles which must always be followed may safely be laid down.

Don't Judge Illumination by the Brightness of the Lamps.

Judge the light you are getting by the way it helps you to see. Do not think because a lamp looks glaring and brilliant that it is giving you good light. It may be merely giving you too much light in the wrong place. On the other hand, a well-shaded table lamp may look dim because it is well shaded, and still be giving first-class light for working purposes.

You must get enough light to see by; and as you see things chiefly by the light which they reflect, it is evident that dark coloured objects, which reflect light badly, require more light than do light coloured objects to see them comfortably. That which is quite sufficient for sewing on white cloth, for example, will not do at all for working on black cloth.

Don't Work in a Flickering Light.

See that your light is steady. If you leave a dark room and go into bright sunshine, the sensation is unpleasant to the eye. If you use a light that flickers, you get this same unpleasant sensation, perhaps as rapidly as twenty times a minute. Furthermore, the eye endeavours to adjust itself to suit the light. If the light flickers it keeps the iris of the eye "see-sawing" as it were, and the muscle that governs it gets tired and reacts on the nerves to cause discomfort and pain. Reading in railway trains causes similar strain; the eye muscles get tired in trying to follow the shaking page, and are likely to provoke a headache.

Don't Expose the Eyes to an Unshaded Light.

It is bad to have an unshaded brilliant light glaring into the eyes, for it throws hard labour upon them in an effort at adjustment. This applies even to common electric, gas, or oil lamps. While artificial light may be made a good substitute for daylight, you have constantly to beware lest rays that are too bright, either from the lamps or from their reflections, hurt the eyes. You can get reflections, so bright as to be harmful, from polished metal or glass, from bright varnished surfaces, or even from glossy white paper upon which the light falls.

A bright light fairly in the field of view means a very brilliant light on the retina, producing fatigue. Everyone knows the blinding sensation of looking at the sun, with its sequence of dazzling coloured images. Babies are here common sufferers when careless mothers or nurses allow them to lie in their carriages with eyes exposed to the unclouded sun. Bright artificial lights, in a less degree, do the same thing to all of us. And when you get a bright light in the field of view, the pupil tries to shut it out. In so doing it renders less bright things all but invisible. Thus it is hard to see things which are nearly in line with a brilliant light, as you often find in facing an automobile headlight, or looking into a show window.

A Couple of Simple Experiments.

Place an unshaded lamp in front of a picture on the wall and then stand back a few feet and note how much of the picture you can see clearly. Then hold a book or paper at arm's length so as just to cover the bright light and note the way in which the picture clears up. Again, put an unshaded lamp about a foot in front of your eyes and try to read a newspaper just beyond it. Then shade your eyes from the lamp and try it again. You will soon find out in this way that lamps can be so placed that they will be a hindrance rather than a help in seeing.

Best Direction of Light.

From time immemorial mankind has received its light mostly from the sky. Consequently, the part of the retina on which the light from above chiefly falls is pretty well used to it, while bright light from below, falling on the part of the retina which commonly gets light only from grass or dark pavements, may be very irritating and unpleasant. Thus the glare from snow and sand is not only disagreeable on account of its intensity, but because of the unusual direction from which it comes. Just so with a brilliant beam reflected from glossy paper on which you are writing. Its rays strike you from an unusual direction and are harmful for that reason. Other smooth and shiny surfaces deliver an equally hurtful assault on that sensitive and much-abused organ—the eye.

Don't Read Facing the Light.

It is best to have the light come from above and somewhat sidewise, as it commonly does in Nature; so that you will not get a brilliant reflection or glare from what you are trying to see. In reading and writing it is better to have the light come from the left, to avoid getting a shadow of the hand that holds the book or pen. Let the lamp be just far enough behind to keep direct reflections from the paper out of the eyes. But what has been said of reflections from paper applies with even more force to the case of polished metals, or the like, over which one is busy. Individual lights placed close over the work are very likely to produce these troublesome direct reflections, and consequently such lights are falling into disuse. In an interior otherwise dark, their use is open to the further objection of giving bright spots of light and so producing too violent contrasts of light and shade.

Don't Use a Bright Light Against a Dark Background.

Almost any light will glare unpleasantly if the surroundings are thoroughly dark. As an extreme illustration, the light from a big arc lamp hung close to the sidewalk may be very annoying at night, but by day you would hardly notice it. Just so a bright lamp against a dark background may be annoying, while against a light background it would not be so unpleasant.

Lamps, Fixtures, Globes, Reflectors.

One may choose to-day among lights of many kinds. There are at hand candles, oil-lamps, open-flame gas-jets, upright and inverted mantle gas-lamps, electric incandescent lamps of carbon and of tungsten, electric arcs of half-a-dozen varieties, besides mercury-vapour tubes, acetylene lamps (as used on motor-cars), and so on through a long list.

What do you wish to use a light for? To read or write by, to bring into view the working parts of a machine, to match colours, to display goods or pictures, or merely to make a pathway safe and plain? Each case is to be studied by itself, and the effect is to be accomplished by such lamps, globes, and reflectors as, properly disposed, will insure ample lighting without glare, and yet with strict economy.

However good and suitable the lamp, it will be put at a disadvantage unless the lighting fixture which carries it is designed to hold the lamp in the right position to enable one to best utilize the light which comes from it. Prettiness in a fixture is well enough. But let the fixture be serviceable first; then it may be also as pretty as you please. But don't buy prettiness if it makes war on good service.

Daylight is naturally well diffused; but artificial light poured out as it is from mere points, or narrow surfaces, needs to be tempered or softened by shades. And it sometimes further requires to be directed upon a desk or table or other object. In some cases, it is better to adopt indirect methods, and throw the beams of a lamp upon a ceiling whence the rays are scattered. For every particular need, there is ample provision amid the abounding lamps, globes, and reflectors of present-day designers.

Arranging Lights.

Two methods are usual in arranging lamps: First, to secure general illumination by so placing the lamps that you may see with comfort anywhere in a room; second, in cases where a bright light is not necessary throughout a room, local illumination can be planned, placing the lights where they will be most used, always remembering that it will not do to localize light too much, since you need for comfortable seeing a fair quantity of light broadly distributed.

Precautions to be Taken in Placing and Shading Lights.

In any artificial lighting the lamps should be so well shaded that the eye does not see them directly nor brilliant reflections from them. You can accomplish this end by putting the light in diffusing globes of, for instance, ground glass or white or opal glass or other translucent material. To secure the best diffusion, the globes should be dense enough not to reveal the form of the actual light source within, but to give the effect of the light pouring forth from the globe as a whole.

Another way of accomplishing the same result is to put a shade round the lamp, which screens it and reflects downward much of the light which would otherwise idly fall on the walls or ceiling. Such shades may be of mirrors or polished metal or white or opal glass, of ground or prismatic glass—all of which, in a measure, work alike. Glass shades are generally preferable to metal ones, for a little light penetrates them sideways—just enough to keep the upper part of the room from being too dark.

Indirect Lighting.

Another scheme successfully used to shield the light is to turn the light from the lamp upward on to the ceiling by means of an opaque reflector underneath. The reflector conceals the lamp, and the brightly illuminated ceiling by which the light is diffused serves as the actual source of the illumination. This plan should be used only on white or very light ceilings, and is subject to a heavier loss for securing diffusion than some other methods; but often this loss is reimbursed by the thoroughness with which the ceiling diffuses the rays that fall upon it.

Don't Use Local Lighting by Itself.

In ordinary cases general illumination is the best way of lighting an interior unless some of the work in hand—as sewing dark goods or reading very fine print—demands exceptionally strong lighting in some parts of the room. In this case local lights may be added; but they ought not to be used without pretty strong general illumination. The commonest sort of localized lighting

is that furnished by a table lamp. Such a lamp should always be shaded to keep the direct light out of the eyes—best by a translucent shade which will add something to the general illumination.

In any one of these plans for general illumination, lights should be so placed as to give at least fairly uniform lighting everywhere in a room. Otherwise, there may be strong and jarring contrasts of light and darkness.

In using shades open at the bottom (such as are very common), their shape and character can be so chosen as to distribute the light precisely as desired. This result can in less degree be accomplished by using enclosed globes or by indirect lighting.

Any of the schemes here sketched can be made to give good results. The choice between them turns upon just what task is required of the light and what its surroundings are to be. Ordinarily, lighting from shades open at the bottom gives a stronger light than other methods; but you must carefully avoid glare in these cases. Lighting by wholly indirect means, in which all the rays are diffused from the ceiling, demands lamps of extra power for the same illumination, but requires little care to avoid glare. Rooms lighted from diffusing globes take an intermediate position with respect to freedom from glare.

Misplaced Brackets.

For a lamp to do its best work, it should not be too near a wall, especially if this wall is dark. Hence only very small rooms can be well lighted by the usual side brackets—say, 4 to 6 feet high. In a large room the eye cannot avoid glare from such brackets unless their lamps are so heavily shaded as to dim the room. In large rooms, where brackets can be placed high enough to be out of the general view, they may be used to advantage; and they are often convenient for occasional use, as in bedrooms, when the room is also lighted by other means.

ECONOMY AND EFFICIENCY.

Don't Waste Light by Using the Wrong Reflectors.

By using reflectors you can put the light from a lamp where it will do the most good, much as an automobile headlight sends the light along the road just where it is wanted. With a lamp without any shade or reflector, the light goes in all directions—only a small part of it falling on the level of the table where it is needed. The rest hits the wall and is reflected about the room, losing intensity at each reflection. Obviously, an unshaded lamp does not throw the light where it is wanted. To ensure the light falling upon the table, you must use a reflector that will bring it there. Of such reflectors there are three general types, either of glass or of metal, which we may call concentrating, semi-concentrating, and distributing. The first acts almost like an automobile headlight, throwing its light downward into a comparatively small area. The second kind spreads out the light over a much wider area, of diameter perhaps as great as the height of the lamp above the table. The third is planned to light a comparatively big area not very intensely at one spot.

No reflector ever increases the total light that streams out of a lamp; it only puts the light where it is needed, instead of letting it go unguided.

Don't Use Shallow Reflectors.

All reflectors should come far enough down over their lamps to prevent you from seeing the bright sources of light themselves without actually looking upward.

Height of Lamps.

With proper reflectors, their height above the table, counter, or bench ordinarily makes little difference, since it is the purpose of the reflectors to send the light where it will do the most good.

Effect of Dark Walls and Coloured Globes.

Because dark walls absorb light strongly, instead of reflecting it, they demand much stronger lamps for sufficient illumination than do light walls. A very dark wall-paper or a dark wood finish may require three or four times as much light as a really light finish. Dark reds, greens, and browns reflect only 10 to 15 per cent. of the light which falls on them. White, cream colour, and light yellowish tints may reflect over one-half the light. Likewise, deeply tinted globes and shades absorb much light—a fact which must be borne in mind in considering economy.

Don't Let Lamps and Globes Get Dirty.

Dirt on lamp chimneys, electric bulbs, globes, or reflectors, absorbs and wastes much light. The country over, it is safe to say that millions of dollars are wasted every year by letting lamps become foul and dust laden. Nor is there any economy in using electric bulbs until they blacken. It pays to renew promptly blackened bulbs and defective gas-mantles.

Don't Save Light at the Expense of Your Eyes.

Saving light at the cost of eyesight is false economy. To get good lighting it is generally necessary to diffuse the light from the lamps either directly, by opal or ground-glass shades, or indirectly, by turning the light first on the ceiling or wall. The use of ground glass involves the absorption of 15 to 20 per cent. of the light to secure diffusion; opal glass of various kinds from 20 to 40 per cent.; while some forms of art glass, and most diffusing ceilings, absorb more than half the light that falls upon them. Even though all these appliances absorb light in the process of diffusion, there is gain in their use, because they yield rays more grateful to the eyes. But your eyes may tire easily even with good lighting. If so, consult an oculist and don glasses if you need them. Eye-strain often comes from defective eyes as well as from faulty lights.

Economy in Selecting Lamps.

In gas lighting there is no economy in using open-flame burners unless the exposure is such that gas-mantles would often be broken. Similarly, with electric lights it is very wasteful, in most cases, to use carbon filament lamps when tungsten lamps are available. The carbon lamps cost less to instal or replace, but much more for electric current.*

AMOUNT OF ILLUMINATION REQUIRED.

The common unit of illumination is the foot-candle, meaning thereby the light which the object would receive from a standard candle at the distance of one foot. This is the measuring rod, as it were, by which comparisons are made.

No absolute rule can be laid down for the number of foot-candles required for good seeing. Individuals differ widely in their requirements; and the conditions under which the light is used cause still greater variations in requirement. However, where lighting arrangements are well planned, it has been found by experience that ordinary reading, writing, or work on white or light coloured material can comfortably be carried on by most people with an illumination of 2 to 3 foot-candles. For sewing dark goods, or reading fine type, 5 foot-candles are none too much. For drafting, engraving, watchmaking, working on black cloth, and the like, from 7 to 10 foot-candles should be furnished.

Artistic Effects.

In a room suitably arranged for comfortable seeing, you may have plenty of light, but the general effect may be displeasing. The illumination may quite fail to bring out the good points of the room in architecture and decoration, or may play pranks with the appearance of persons or things in the room. One may not object to ghastly tints in a factory; but in lighting a drawing room such effects would not be tolerated. Hence one often should sacrifice strict economy to get the most pleasing effect in the room. The fixtures that carry the lights should harmonize with their surroundings if the general effect is to be agreeable. Handsome fixtures have a decided decorative value whether their lamps are lighted or not. As strongly coloured objects give something of their own hue to all the light which they reflect, the colour of lamp shades, walls, and furnishings plays an important part in the artistic effect.

* The amount of electricity taken by an electric lamp is expressed in watts. Most electric lamps now manufactured have the number of watts which they are rated to consume printed on a label on the bulb. The old-fashioned carbon filament incandescent lamp of 16 candle-power has the candle-power on the label, and takes from 50 to 60 watts. To determine the cost of operating an electric lamp, divide the number of watts it consumes by 1000 to reduce to kilowatts, and multiply the number of hours the lamp is to be operated by the kilowatts, to obtain the kilowatt-hours of electrical energy. The kilowatt-hours multiplied by the rate per kilowatt-hour which is charged gives the cost of operation for the stated time. The consumption of gas-lamps is expressed in cubic feet of gas per hour. The number of cubic feet of gas per hour taken by a burner, divided by 1000, and multiplied by the cost per thousand cubic feet of gas, and by the hours of burning, gives its cost of operation for the stated time. The consumption of open flame burners is commonly taken at 5 cubic feet per hour. Upright single mantle burners usually take from 3½ to 5 cubic feet per hour, though some smaller ones take less. Most individual inverted gas mantle burners take from 3 to 3½ cubic feet per hour.

First Report of the British Commercial Gas Association.

We have received the first annual report of the above-named Association. The contents, which occupy about 340 pages, consist mainly of the full report, reproduced from the "JOURNAL," of the proceedings at the conference held in Manchester on the 8th and 9th of October, under the presidency of Mr. Corbet Woodall, J.P., D.Sc., M.Inst.C.E. This is preceded by the "Notes at the Conference" which appeared in our columns at the time; and in an appendix are given the comments of the technical and lay press on the event. Other portions of the contents are an index to the speakers, lists of the officials, &c., of the Association, of undertakings contributing to its funds, of firms supporting it, and of the publications in which its advertisements have appeared. Interesting features of the book are the numerous single and grouped portraits which embellish it—beginning with one of the President (as a frontispiece) prepared from the portrait in oils, by Mr. Fiddes Watt, presented to him by the staff of the Gaslight and Coke Company on the occasion of the centenary, and followed by others of the Deputy-Chairman of the General Committee and Chairman of the Executive Committee (Mr. F. W. Goodenough), the members of the latter Committee, the Past President (Mr. R. G. Shadbolt), the officers of the Association, and of ladies and gentlemen who took a prominent part in the proceedings. In addition to the portraits, there are pictures of places and events connected with the conference which will form interesting *souvenirs* of the gathering. The book, which is bound in a stiff paper cover, has been produced under the supervision of Mrs. M. A. Cloudesley Brereton, the Association's Editor.

SOCIETY OF BRITISH GAS INDUSTRIES.

The Autumn General Meeting of the Society was held last Wednesday, at the Trocadero Restaurant, Piccadilly Circus, W.—the PRESIDENT (Mr. Corbet Woodall, J.P., D.Sc., M.Inst.C.E.) in the chair. The attendance of members from the 105 firms on the roll of the Association was excellent. Before the business meeting, by the invitation of the Chairman of the Council (Mr. T. S. Clapham), the members had tea together.

THE BUSINESS MEETING.

UNIVERSITY DISTINCTIONS.

On assembling in the meeting room, the PRESIDENT, on taking the chair, was enthusiastically received by the members.

Mr. CLAPHAM at once rose, and said he was sure the members would not pardon him if, as Chairman of the Council, he did not remember that their President and two Past-Presidents had been honoured—two by the University of Leeds, and one by the University of Manchester. He desired therefore to propose the following resolution:

> That the cordial congratulations of the Society be tendered to the President and to their Past-Presidents, Mr. Thomas Newbigging and Mr. Dugald Clerk, on the honour of the degree of Doctor of Science which had been conferred upon the two former by the University of Leeds, and upon the latter by the University of Manchester, and that this resolution be recorded in the minutes of the Society.

He would take the last-mentioned name first. Mr. Dugald Clerk was their first President; and he served the Society valiantly and well. The members remembered the services he gave ungrudgingly in connection with the work of formulating the standard clauses of contract. They had both his influence and his great experience placed at their disposal; and those who were working for the Society in the days of its infancy well recollected the kindly, genial efforts which Mr. Dugald Clerk gave towards consummating this particular object. Then Mr. Thomas Newbigging came along, and occupied the chair. He (Mr. Clapham) called Mr. Newbigging the Grand Old Man of the gas industry. [Hear, hear.] He honoured their Society by filling the presidency; and he conferred honour upon the office. He performed the duties of the position to the great satisfaction and pleasure of the members. His years did not allow him to give so much time as he personally would have liked to their affairs; but at every meeting at which he could be present, he was at his post, fulfilling his duties. Mr. Newbigging did a great deal in cementing the unity and the happy feeling which now existed between the manufacturing industries and the gas-supply industry. Then there was their President (Mr. Corbet Woodall). They had said before, if not publicly, at their Committee meetings, that it was a great honour to the Society to have Mr. Corbet Woodall as their President. He had a very full year before him; and with many important and great duties devolving upon him, the members did think it was a great privilege to have his help and service. They naturally hoped that throughout the year he would have good health; and that they would see him in good form when next they meet in full numbers.

There was no need for a seconder to the resolution; for it was at once carried by acclamation.

The PRESIDENT, in replying, said, on behalf of the two gentlemen whose names had been mentioned, as well as on behalf of his friend Mr. Carpenter and himself, he wished to acknowledge the kindly way in which they had recognized the honour done them by the University of Leeds and, in the case of Mr. Dugald Clerk, by the Manchester University. It occurred to him (the President) that it was in the direction of that harmonious co-operative spirit which seemed to animate them all just now (and he hoped would long continue) that this expression of good will should take place. He thought the Society had been fortunate in the men—omitting the present year—["No, no"]—whom it had had to preside over it. What had taken place among the members of the Society was similar in spirit to that which found expression very largely in the meeting in Manchester of the British Commercial Gas Association, which had surprised a great many of them. That the same cordial spirit might go on and increase was the wish of them all. With regard to himself, it would be remembered that he hesitated very much about accepting the position the members were good enough to offer him. He was not at all sure that it was wise that one connected with the purchasing side of their industry should be so prominently connected with the manufacturers or the selling side. But, seeing that they were all interested in the one aim of forwarding the interests of the industry, there was no reason why anything but good should accrue from the combination of their efforts.

Mr. CLAPHAM remarked that he had not included the name of their friend, Mr. Carpenter, in the resolution, because he had not passed through the chair of the Society; and he (Mr. Clapham) therefore confined the resolution to those who had been Presidents. Nevertheless, they sincerely congratulated Mr. Carpenter. It was a particularly happy day for him (Mr. Clapham) when these degrees were conferred; for on that day four friends were gowned—a townsman of his own being one of them.

NATIONAL GAS EXHIBITION OF 1913.

The PRESIDENT said it had been decided to take the general business before the paper which was to be read by Mr. Pearson-Perry; and he understood the general business was to be confined to the coming exhibition. As the members knew, it had been resolved to make the exhibition something different from what had gone before; and to make it, as far as in them lay, a thorough, complete, and huge success. The chances of its success were greatly improved by the fact that every branch of the great industry was interested, and taking an active and helpful part in its promotion. One thing that would distinguish the exhibition from those that had gone before was the fact that it was not to be a show of individual firms—a mere repetition one of another—as their exhibitions had been in the past. It was to be a co-operative show of progress in the manufacture and uses of gas. He (the President) thought that it spoke well for the prospect of success that this had been accepted particularly by the members of the Society. The temptation to each firm to show those objects to the development of which they had individually devoted money, time, enterprise, intelligence, and scientific research, was strong, and that the firms should be

WILLING TO SUBORDINATE THEMSELVES

and to take part in making the demonstration of their particular branch of the business as complete and popularly attractive as possible, was, to his mind, a significant expression of the appreciation of the unity of their industry and of the oneness of their aims. He (the President) was quite sure that this determination to exhibit jointly, not in competition, the work that was being done in each direction of the application of gas—was right for the purpose in view. One naturally took such things as gas fittings, stoves, fires, and so forth as probably being most interesting to the general public; and in respect of these a combined show of the advances made by the trade as a whole would be far more instructive and attractive to the public, which was the purpose all had in view. The fact that the members of the Society had subordinated the individual to the exhibition was, in his opinion, a most promising element in their anticipation of success. He could quite understand there were difficulties. He heard at the last meeting at which he was present references to

THE LIGHT AND THE HEAVY SIDES

of the business of the Society's members. Since he came to the meeting, someone had suggested that, while the light side would stand to find immediate advantage in the success of the exhibition, it would not be so with the other side. He (the President) thought that must be an error which would be apparent to anyone who looked at it. Just as the gas undertakings of the country stood to win by the prosperity of the whole show equally with those in and near London, so the makers of apparatus for manufacturing gas also stood to win. They could not make the gas which was to be sold as a result of the exhibition, or as the result of any other method of promoting the uses of gas, without having the plant wherewith to produce the gas. It seemed to him therefore that the beneficial result was almost, if not quite, as direct for the heavy side as for the other. In his opinion, there was no occasion for contemplating any difficulty of that sort. "We are all one, and all equally interested." The only other observation that occurred to him was that to make the exhibition the success that was intended, they had to provide

A CONSIDERABLE SUM OF MONEY

—he might say a very considerable sum of money. It was not for him to suggest just how it was to be found, except this—that everybody must take his part. He hoped there would be no talk about this being a London show; but that, from end to end of the country, they would have the companies and municipal gas undertakings—they were already doing so to a large degree—freely taking part in it. The British Commercial Gas Association had given them a good lead; and from what had been done in connection with that, they could anticipate what could be done if the whole industry participated in such work as this. So far as the members of the Society were concerned, he felt sure they would not be behind in taking their share in that by which they stood—by which the whole gas industry stood—to gain very materially indeed. He commended the matter to their earnest consideration.

Mr. F. W. GOODENOUGH, Chairman of the Executive Committee of the National Gas Exhibition, invited by the President, said he had to express his thanks to the Council of the Society for having invited him to be present there that evening as the one outsider in the meeting—the one person with no prescriptive right to be there. He did, very much, welcome the opportunity of speaking to the members of the Society of British Gas Industries on this important question of the National Gas Exhibition. The Council did him the honour of asking him to attend their meeting that morning, in order that they might discuss various points with him; and to raise one or two questions upon which they thought he might usefully touch that evening. He felt at the moment very much like the member of the House of Commons who had notes prepared for a speech, lost them, and then heard someone else make the speech before him, because the President had touched upon, and in a much better way than he could do, several of the points he (Mr. Goodenough) had intended mentioning. It would be remembered that this

NATIONAL GAS EXHIBITION

was first mooted by the Council of the Institution of Gas Engineers in connection with the celebration of the Jubilee of the Institution. They then approached the Council of the Society of British Gas Industries. The first thing that must be conceded, he thought, was that

the only place for such a National Gas Exhibition was in London. That this was generally accepted was evidenced by the fact that already some of the leading provincial gas undertakings in all parts of the kingdom had guaranteed support to the extent of £5000; but this was only the start. It was coming to be recognized that co-operative effort must have its centre in the capital of the country if it was to have a beneficial effect upon the industry throughout the length and breadth of the country. Therefore he did hope that everyone who was considering the question of supporting the exhibition would look upon it as a National Exhibition, and not in any sense as a London one. He had also been asked to refer generally to

THE SCHEME OF THE EXHIBITION,

and to the allocation of space and so forth in consideration of the guarantees given. As the President had already said, and as the members were aware from the information that had been circulated, it was proposed that the greater part of the space should be devoted to a co-operative exhibit, for showing the applications of gas under working conditions, both for domestic and industrial purposes. There would necessarily be a certain portion of the space devoted to exhibits that could not be co-ordinated with such a co-operative exhibit. There would be space in which power machinery could be shown in operation, and other plant and appliances—manufacturing apparatus, testing appliances, and so on—that could not be brought into the co-operative scheme. The Exhibition Committee, he should like to remind them, represented equally the interests of the Society and those of the Institution of Gas Engineers. It was a happy arrangement that there should be equal representation throughout; and thus all those who put down money for expenditure by the Organizing Committee would have the feeling that their interests were being looked after by their own representatives. It was in the minds of the Committee that, if the guarantees were adequate, as they believed that they would be, the guarantors would be allotted space or position in the co-operative exhibit without any further expenditure on their part for space or rent of positions. If the guarantees eventually more than covered the expenses, there would be a proportionate return to the guarantors. Of course, over and above the money received as guarantees, there would be the rent of the space in the extra-co-operative exhibit—the portion of the buildings let to outside firms—which would go to swell the revenues of the exhibition. If there was a profit, it would be divided equitably between the manufacturers and the gas undertakings. Many firms had asked in what way they would individually benefit from the coming exhibition. The President had already touched upon this point. They hoped, and they knew, that every one would benefit each in his own degree by the general expansion of business that would follow a successful exhibition. The exhibition, it seemed to him, came at a most appropriate and valuable moment. They knew that it was much easier to get up pace on a machine when once the machine had begun to move. There was no doubt the work of the British Commercial Gas Association, and the publicity work that had been done locally by gas undertakings up and down the country, and by the assistance of the manufacturers in small local exhibitions, had started the gas industry on a new lease of life, and

A BOOM HAD BEGUN;

and while this movement was in progress, a big exhibition would set the speed at a faster rate than anything they had experienced or had been expecting in the past. The President had referred to the fact that, when more gas was sold, more apparatus was required, more plant had to be used, and more repairs had to be executed. When one mentioned that the increase in the sale of gas in the Gaslight and Coke Company's district, as far as one could see, would be some 1000 millions in the present half year, it did not need much imagination to see that, sooner or later, orders for additional plant must be placed to keep pace with an increase of demand such as this. Their increase was in no sense exceptional at the present time. He heard of 14, 12, and 10 per cent. increases up and down the country. If the moderate amount of publicity that had already been done, preceded as it was by a big coal strike (so that the two things helped one another), produced the increase of business seen at the present moment, one might confidently anticipate still better results from a big publicity movement such as a gas exhibition. What would be done for those who had guaranteed substantial sums and did not desire to take space? Some of them said they had nothing which they felt would be suitable to show in the exhibition. There must be very few of these firms who would not have drawings which they could use to illustrate plant, even if they did not wish to exhibit the actual plant itself. There would be no difficulty whatever in an exhibition of this character about giving prominence to the claims of all manufacturers who had loyally and liberally supported it, even if they did not wish to take part in the show. It would be quite easy, for instance, to inscribe on a panel the names of firms who had put their names on the guarantors' list, so that every gas engineer would know that honour was due to those firms even though they were not actually showing gas apparatus.

The President having to leave the meeting at this point,

Mr. CLAPHAM, Chairman of the Council, took the chair.

BRITISH COMMERCIAL GAS ASSOCIATION AND THE SOCIETY'S CO-OPERATION.

The CHAIRMAN said he was sorry the President had another engagement which prevented him remaining for the dinner. The discussion on the question of the exhibition would be taken at a private sitting of the members at the close of the other business before the meeting. There was another matter on the *agenda* regarding the British Commercial Gas Association and the Society's Co-operation therewith. The Council had intended to consider this matter at their meeting that afternoon; but they had really had so much work to do (they had had three hours' close sitting) that this particular subject had to be shelved; and it would be brought up at the next meeting of the Council. He should, however, like to report that the Society had contributed and had sent in money to the Association to the extent of £2115. It would be remembered that this was an annual subscription; and they had undertaken to subscribe for three years. Every member of the Society who promised to subscribe had sent in his subscription; but there were many members who had not subscribed. They wanted to get every member in. They must all begin to feel—every member who attended the Manchester meeting must feel—that this was an important matter, and one well worth placing money in. It was unfortunate that they had to appeal for money when they met together; but they could not make things go in these days without money. They were not appealing to those who had subscribed already, but they were asking again for the serious consideration of the matter by every member who had not subscribed towards this important fund. He hoped that the non-subscribers would take this to heart; and that Mr. Griffith, their Secretary, would soon hear from those members that each would plank down £100 (more or less) for the next three years.

ACKNOWLEDGMENTS.

A vote of thanks was next passed on behalf of the Society to the Manchester and Salford Corporation Gas Committees for their reception, at the recent congress in Manchester of those members who are members of the British Commercial Gas Association.

Mr. F. J. WEST proposed a vote of thanks to Mr. Goodenough, for having come to the meeting to give the members an outline account of the projected National Gas Exhibition.

Mr. W. D. HELPS seconded the motion; and it was heartily carried.

Mr. GOODENOUGH, having acknowledged the vote, said it gave him an opportunity for endorsing the Chairman's appeal to the members who were still non-subscribers to the British Commercial Gas Association. As Chairman of the Executive Committee of the Association, he could say they were always suffering from shortness of cash; and while he was glad to be able to say that since the Manchester conference they had got another £600 subscribed by gas undertakings, they wanted plenty more. If the members of the Society would only give them £5000 instead of £2000, they could promise it would be well spent, and that they would get £10,000 profit out of it. [Laughter.]

RECENT DEVELOPMENTS IN THE MANUFACTURE OF REFRACTORY GOODS FROM FIRE-CLAYS.

Mr. G. H. PEARSON-PERRY, of Stourbridge, read a paper on this subject. The communication and a report of the discussion appear below.

DINNER AND ENTERTAINMENT.

In the evening, the members dined together, with the Chairman presiding. Only the loyal toast was honoured; the after-part of the evening being occupied by a musical entertainment, for the direction of which the Hon. Secretary (Mr. Cyril G. Davis) was responsible. The entertainment was very good; and the artistes' talents received merited appreciation.

RECENT DEVELOPMENTS IN THE MANUFACTURE OF REFRACTORY GOODS FROM FIRE-CLAY.

By G. H. PEARSON-PERRY, Chairman of the Fire-Clay Section of the Society of British Gas Industries.

[A Paper read before the Society of British Gas Industries, Nov. 20.]

The subject of refractory materials is unquestionably an extremely important one—vitally affecting, as it does, not only the interests of the gas engineer more particularly, but the success of those who are actively engaged in a large number of industries where the attainment of high temperatures is indispensable. Consequently, the subject is daily coming more and more under the notice of experts, with a view to accumulating such data as shall lay the foundation for the establishment of a standard product which shall adequately discharge the functions to which it must be applied, or at least come as near to that desideratum as the range of the possible allows. Whether the result of this activity will prove to be the hastening of a state of millenium so far as furnace work is concerned, has yet to be witnessed. But one thing is certain—it should result in the elimination of a good many difficulties and defects which have previously been encountered, and which have resulted in dearly-bought experience.

The subject has been brought more particularly to the front by the establishment of the Committee on Refractory Materials by the Institution of Gas Engineers; and the reports issued by this Committee are brimful of interest to all directly or indirectly concerned in the manufacture of fire-clay goods. The "inroads," if I may use the expression, which this Committee have made into

the province of the fire-clay manufacturer—these organized encroachments—are no doubt fully warranted, and the manufacturers make no complaint; for if the effect of the aggression is to bring to light any new facts which shall ultimately result in the appearance of a better and longer-lived product, the criticism will have fully justified itself and ingratiated itself in the view of all. It should be stated here that already something has been achieved in this direction.

Briefly, the object of this paper is to show to you, as users of refractory materials, that not only are you directing your energies in this direction, but the manufacturers of fire-clay goods are themselves alive to the situation, and are endeavouring at all costs to meet the requirements set up by the standard specification formulated by the Committee already referred to, the design of which is to bring about that "consummation devoutly to be wished" by both manufacturer and user.

Mr. Bywater, of the South Metropolitan Gas Company, has already dealt with the subject in a way that leaves little to be said from the point of view of the gas engineer; and the manufacturers are extremely indebted to him for bringing this important matter to the front. It can safely be said that many recent improvements in the quality of fire-clay goods are, in a great measure, due to his displayed interest and initiative.

There is every hope that this healthy co-operation between manufacturers and users will have the effect of establishing such measures and precautions by both as shall result in a satisfactory standard of uniformity. We represent, it is true, different individual and personal interests; but we have to remember always that we have interests in common with each other. The prosperity of one industry is often interwoven with the success of another. Consequently, this friendly criticism and interchange of views on a subject of mutual interest cannot help but be advantageous. For this reason, the fire-clay manufacturer appreciates any practical suggestions coming from users of fire-clay goods, and welcomes the promulgation of any view likely to enhance the general usefulness and reliability of fire-clay equipments, even though this entails some expense. It must be the object of the manufacturer, so far as he possibly can (subject to practical manufacturing limitations) to meet the wishes of those engaged in industries employing fire-clay products; while, on the other hand, it must also be the duty of the latter to consider and duly recognize what practical difficulties there may be in the way of fulfilling his demands.

The notes I propose to give you with regard to the matter are entirely from the point of view of the manufacturer [the gas engineer's standpoint having already received a fair share of attention]; and I shall restrict my remarks solely to one of the most common of refractory materials—viz., fire-clay—on which my experience runs. We have been told again and again that the raw materials of this country at the disposal of the fire-clay manufacturers are superior, or are certainly quite equal, to those possessed by our foreign competitors. Our workmen are also equal, at any rate in the direction of intelligence. But the department in which we have been supposed to be lacking has been in our manipulation of the materials with which Nature has been kind enough to endow us. That this may have been the case time back I do not deny; but I do submit that urgent demands have of recent years impelled the British manufacturer to reconsider his methods, and that at the present time some of the manufacturers at least are earnestly endeavouring to keep themselves abreast of legitimately imposed conditions. In support of this, I shall endeavour to outline very briefly the methods in vogue in the manufacture of fire-clay goods.

If the rules of composition insist that I should commence with a definition, we should say that fire-clay is a material which will withstand high temperatures without fusion. Thus chemical composition is ignored so long as this one property is retained. For various purposes, however, it is recognized that it is of extreme importance that certain chemical properties should be possessed by the clay if the standard set up by the Committee on Refractory Materials is to be complied with. This at once imposes upon the manufacturer of fire-clay goods a heavy responsibility in the selection of the right material for the purpose.

Winning the Clay.

As no doubt you are all aware, fire-clay is extensively found in several areas of this country—notably Stourbridge, Yorkshire, and Scotland. In the Stourbridge district, with which I am specially familiar, the clay is found at a great depth—some considerable distance below the coal seams. For the winning of the clay, the sinking of a shaft is thus necessitated; and as these shafts extend to a depth of some 600 feet, some very heavy expenditure is incurred right from the beginning. The best fire-clay is always found beneath the coal. With the routine of the miner's work, you will probably all be more or less familiar; and in a paper of this type I cannot do more than assure you that no effort is disregarded down the mine which will result in the extraction of the very best material. The clay with which we originally start our manufacture must have special natural qualities determining its choice; and unless such a clay is secured, no amount of artificial manœuvring will render it satisfactory.

The position of the right clay having been accurately determined, and the very best-grade material having been won, much has yet to be done in the matter of selection. Analyses and tests thus account for considerable attention. It is quite apparent that if expense is to be spared in any department it must not be here; for unless we start with the very best material, the finished product cannot be expected to be good and lasting,

It must be pointed out that often the clay occurs in various strata in close proximity to one another, but each having different compositions and properties. Now, if all the seams were mined together, the expense would certainly be less; but the indiscriminate mixing of the various seams in unknown quantities could not be expected to give such reliable results as where each particular seam is mined separately, and definite proportions of each employed so as to ensure a combination of the best qualities. Great care, therefore, must be displayed in the separation.

As the clay is being extracted from the mine, experienced workmen at the top of the shaft go carefully through each truck-load of the excavated clay, and sort out and reject any pieces of foreign material which may still happen to be associated with it; and it is not until after this has been done that the trucks are allowed to pass on to their respective heaps. A foreman of long experience is always stationed at the top of the mine; and it is his duty to supervise the loaders, and to see that every care is exercised to guard against the unfortunate results which would naturally attend any indiscriminate or indifferent selection.

Each of the varying grades of clay having been carefully separated, analyzed, and tested, and having acquainted ourselves with the different properties of the respective types—such as contraction, &c.—and the needs which each grade will specially fulfil, we set out to bring about a final product which will embrace the maximum of these requirements.

In looking at the variety of raw clays at our disposal—the compositions of which have been so often discussed that I propose only to touch briefly on this point—the main factor of importance as regards refractoriness is the low percentage of alkalies. Next in order of importance is a consideration of the silica and alumina present. It has been shown by Ries that "given clays of equal percentages of fluxes, the higher the percentage of silica the lower the refractoriness." Another item which, until recently, analysts have practically, if not entirely, disregarded is the presence of titanium, 2 per cent. of which, however, is said by the same authority to lower the refractoriness one cone. It will thus be seen that the material with which we start must be as free from these injurious elements as it is possible to get from Nature.

Weathering.

Having put before you very briefly a few of the most important considerations affecting the mining, I have next to remind you of the urgent necessity of adequate weathering. The importance of this phase of the subject cannot be over-estimated. Our clays as a rule are not over-plastic; but, happily, the effect of the weather is to bring about a great improvement in this desirable quality, as well as to give an increase in the direction of tensile strength. It should also be remembered that not only does the process of weathering affect the plasticity of the clay, but it has the effect of largely reducing the percentages of those undesirable alkalies, some slight presence of which we have always to contend with, even when we have done our very best in the direction of mining. The effect of the weather in this connection has been clearly shown by Mr. Bywater, in his paper on the "Testing of Fire-Clays," published in the "Transactions" of the Institution of Gas Engineers.* Weathering being indispensable in the production of a good grade fire-clay, large stocks, amounting to many thousands of tons, have consequently to be laid out to undergo this treatment.

Having in view the results of the studies of others as to the effect of the weather, especially in the direction of the elimination of alkalies, the appended analysis of Stourbridge clay, taken straight from the mine before having come under the beneficial influence of the weather, will probably be interesting.

Clay Dried at 109° C.	Per Cent.
Silica (SiO_2)	61·73
Titanic oxide (TiO_2)	1·49
Alumina (A_2O_3)	25·61
Ferric oxide (Fe_2O_3)	1·05
Magnesia (MgO)	0·12
Lime (CaO)	0·48
Potash (K_2O)	0·64
Soda (Na_2O)	0·07
Loss when calcined over 109° C.	8·92
Phosphoric oxide (P_2O_5)	*nil*
Sulphur trioxide (SO_3)	*nil*
Carbon dioxide (CO_2)	*nil*
Hygroscopic moisture lost at 109° C.	1·53

Now if, as has been pointed out, alkalies constitute a barrier to refractoriness, by the time the weather has worked its wonders on such a clay, evidently the alkalies will have been considerably reduced, and the ultimate product should be highly refractory. Perhaps the most important point, however, in the preparation of fire-clay is the introduction of "grog." If clay alone were used for the manufacture of a fire-clay article, the body would be too closely textured. It becomes necessary, therefore, to introduce a loosening constituent in the form of grog, which is generally understood as burnt fire-clay. It is in this addition to the mass that many of the faults attributed to so-called refractory goods might be traced; and the maker needs to exercise the utmost care and ingenuity in this department.

In some cases, the grog used is made from refuse fire-bricks—an unsatisfactory method, because of the possibility that the fire-bricks may, in the course of their work, have picked up

* See "JOURNAL," Vol. CII., p. 831.

various impurities. Although a seemingly small matter, this has often very damaging results. Grog for the best work should always be made from the same seam as the subsequent article, and should be fired as hard as, or preferably harder than, the finished article. It is impossible to emphasize too strongly the necessity for the correct introduction of grog. Having settled that the quality of it shall be as good as the article to be made, the question of quantity next comes up, and also the question of the size of particle.

Edwards and Leese, some years ago, gave to the English Ceramic Society the results of experiments undertaken by them in this connection. These investigations were made specially from the point of view of pottery saggars; but it will be seen that the conditions met with in gas-retorts are very similar, as both high temperature and sudden variations are encountered, while a fairly high tensile strength must be maintained. In summing up the results obtained by them, Messrs. Edwards and Leese state the following to be the effect of increasing first the sizes of the particles: (1) Reduction in contraction; (2) decrease of strength, both in the green and fired states; (3) greatly increased resistance to fracture by sudden temperature changes; and (4), increased porosity. They next considered the effect of increasing the proportion of grog, and found this to be: (1) Decreased contraction; (2) decreased strength; (3) no effect on temperature changes; and (4) increased porosity.

Mellor, in a paper recently read before the Metallurgical Society at Wednesbury, also gave his views on the use of grog, from which I may be permitted to quote. He pointed out that a brick highly charged with coarse grog was less likely to crack with sudden temperature changes, and that, therefore, grog should receive more attention than hitherto. It was obvious, he said, that if the grog were thoroughly shrunk the residual contraction of the brick must be less than if grog were used imperfectly shrunk; also that if a grog were employed made from a lower grade clay than was used for making the fire-brick, the quality of the resultant fire-brick must be reduced in a corresponding manner. Grog is of vital importance, acting as it does as a kind of skeleton for the fire-clay, and preventing undue shrinkage and warping. Moreover, it profoundly alters the structure and properties of the brick. With certain limitations, Mellor proves that the coarser the grog and the greater the amount used, the less the tendency of the brick to crack with sudden temperature changes. But the crushing strength of the brick is at the same time reduced. The limiting amount of grog which can be employed is determined by the plasticity of the clay. The finer the grog, the less marked its effects. Heath, before the Ceramic Society, has also shown that the smaller the particles, the greater the tensile strength; careful experiments enabling him to put the results in tabular form, which are very interesting.

It will thus be seen that the relative sizes and proportions of the constituent parts of a fire-clay article have a marked influence on its qualities. Large grog means low tensile strength with high resistance to temperature changes; small grog means high tensile strength with low resistance to variations of temperature. It is for the fire-clay manufacturer to give the happy medium which will produce the best result for the particular purpose for which the article is to be used. It is necessary for him to carefully prepare the grog from the best material, remove all dust, and then as carefully sift and select the particles into their respective sizes—remembering always that if the particles are too large tensile strength is diminished, while, on the other hand, if they are too small the power of resistance to sudden changes of temperature is lessened.

The foregoing will show the extent of the problem which the producers of fire-clay goods have had to face, and the careful experiments which have been necessary to ascertain which size or sizes of grog, and in what proportion, give the maximum of each of these desirable qualities. But perhaps an even greater problem has been that of ensuring that these carefully ascertained proportions are duly observed in actual work. Incidentally it may be mentioned that this is practically a new condition of manufacture, dating back only a few years; and it has entailed the erection of special plant, adding considerably to the expenses previously borne. If, however, the result of this additional expense is the production of a material having the correct amount of porosity and tensile strength as will enable it to fire-up well to the necessary cone, and permitting a reasonable amount of expansion and contraction without detriment to the fire-brick, is not the outlay well repaid?

Mixing.

Having disposed of the question as to the correct proportions of clay and grog to employ, as well as the correct size of particle of the latter, we next have to discover the best means of mixing them together. At a large works enormous quantities of the different materials have to be dealt with each week, and the introduction of machinery in the form of pugs has in great measure superseded the old-fashioned method of "treading" the clay.

Manufacture.

Now a word as to the making. Having reached thus far, and having shown the clay such marked attention in all its various stages up to now, we naturally see to it that in the making of all classes of goods, particularly for such special work as gas-retorts, only the most experienced workmen are trusted with the manipulation of it. The routine of the making shops is rather technical in character, and to give a descriptive survey of it would probably be irksome in a paper of this type. Suffice it, therefore, to say that even the smallest details receive the utmost care. Happily, therefore, complaints are few; but I shall have a little more to say on this point before I conclude.

Firing.

Made and dried with great care, we have next to consider the best means for firing such huge pieces as gas-retorts. If a retort is required to withstand a temperature of (say) 2500° Fahr., it should receive in its manufacturing fire a temperature at any rate not less, and preferably higher. This heat, however, must be very gradually applied, especially in the early stages, in order to avoid any cracking or warping, After all water and consequent shrinkage have been eliminated, the firing may be more rapidly increased.

A point which should not be overlooked here is the colour of a finished fire-clay article. Colour is not always a criterion of quality. Usually a thoroughly shrunk fire-brick has a dark, and sometimes blotchy, appearance; whereas an imperfectly shrunk brick often has a lighter and more pleasing appearance. This frequently results in difficulty. Purchasers are often inclined to view a dark coloured brick with some suspicion, preferring the lighter coloured article. It should be pointed out, however, that, some of the very best fire-clays, having had excellent treatment throughout, exhibit these apparent surface "imperfections;" so it is necessary to exercise care and judgment in this respect.

Importance of Good Material.

The extreme importance of having the most efficient fire-clay obtainable will at once be apparent to those connected with the retort-house at a gas-works. Given a good material which will properly discharge the necessary functions, this is where the gas engineer expects to make his profit of quantity and quality of gas to make his expenses. Retorts have not only to withstand high temperatures; but the charging and discharging of them results in their being exposed to considerable fluctuations of temperature. Not only have these variations in temperature to be accounted for, but load conditions have also to be taken into account. Moreover, stoking machinery creates some strain. High porosity and tensile strength—two opposites—have to be reconciled; and it is in this reconciliation where the manufacturer's ingenuity is revealed.

There is no question, as I have said, that British clays are equal to the emergency. Moreover, English manufacturers are not unwilling to supply a material which shall be equal to standard specification—indeed, they are most willing and anxious, as far as in their power lies, to do so. But the great care and attention necessary in every department to secure compliance with these stringent demands spells, as I have sought to show, increased cost of production. Incidentally, I might also mention the increased expenditure incurred by the provisions of the Mines Regulation Act. While embracing the developments through which the fire-clay industry is passing, the manufacturers ask that due recognition should be paid by consumers to the increased costs entailed by these more modern stipulations.

Proper Treatment of the Manufactured Article.

Finally, having once got the right material for the purpose, as a result of scientific thought and efficient mechanical manipulation, it must receive ordinarily careful treatment by the user. Very often the failure in a gas company's settings is straightway attributed to the firebricks; whereas it is often the result of the furnace having got out of hand, and fuel ash and flue dust having attacked the brickwork. Due regard should be paid by the gas engineer to the suitability of the various classes of bricks for particular purposes, and each variety should be utilized in the position it is most suited to withstand. A brick which possibly has superior refractory qualities under conditions where no load is imposed might behave very badly indeed under different conditions, and possibly result in serious disaster, inasmuch as the retorts might also be damaged in consequence. In such an event, the responsibility would rest neither with the fire-brick manufacturer nor with the retort maker, but with the engineer for using good bricks in unsuitable positions.

Retorts which last nearly three years at one gas-works should with ordinary care last correspondingly well at another. But this is not the case. The fire-brick is unfortunately a handy source to which to attribute a fault. I offer a plea that the fire-clay firms shall not be made the butt for everything which happens to go wrong in a furnace setting, and blamed for circumstances over which they have no control. They have already a fair share of responsibility in providing a material capable of meeting elaborately compiled specifications. They can only give gas engineers the very best material, manufactured with due regard to their various requirements, and at a price commensurate with the work entailed in its production, and then leave it in their hands, to receive as careful and scientific handling in use as it has received in its manufacture.

Discussion.

The Chairman (Mr. T. S. Clapham) said if the attention the members had given to the paper was any guide, he thought they would all agree that this subject (which some of them considered would be rather dry) had proved most interesting. Personally, he knew very little about refractory goods from fire-clay; he having devoted much more attention to the science of making a good

casting. At any rate, he had learned much more from the paper about refractory materials from fire-clay than he knew before. Judging from his own feelings, and the marked attention shown during the reading of the paper, it had been of the highest interest to the members, and as good as any paper they had had submitted to the Society. He could not say anything that would be useful on the subject; but there were gentlemen present with an intimate knowledge of fire-clay and the manufacture of fire-clay goods, and there were gentlemen present who had to use these goods. He hoped they would contribute to the discussion.

Mr. Albert Cliff said, in thanking Mr. Perry for his paper, he thought it would have improved the occasion if copies of it had been supplied a few days before the meeting, especially as the importance and complex nature of the subject required very careful speech. In the first place, he should like a word on the commercial aspect of the question. In one of the closing paragraphs, there was a rather deftly-put suggestion that consumers should pay more to cover the increasing manufacturing costs. Now brickmakers represented a business on which there had probably been less profit in recent years than on any other job affiliated with the Society of British Gas Industries. But buyers were not the people to increase prices. It was their business to take full advantage of the shortsighted policy of brickmakers in cutting keenly one against the other. The remedy was entirely with the makers and sellers of the goods, and not with the buyers. The worry of unprofitable manufacture must be borne entirely by the men who engaged in it; and they must find a remedy among themselves. The serious thing was that the quality of fire-clay manufacture in this country had been prejudicially affected by the absurd cheapness which for some time had obtained. He did feel that they must look to themselves to traffic less in this folly, and to restrict their competition more to quality, the suitability of clay compositions for different uses, selling power, economies in works' practice, and determination to keep promises and to deliver to time. A great deal in the paper was not at all contentious, or only so in a minor way; but he should like to call attention to the paragraph referring to raw materials, and pointing out that English workmen were equal in the direction of intelligence to foreign competitors. It must be admitted and realized that more facilities were given for technical instruction in clay working by some of our Continental neighbours than they had here in England. Their clayworking journals had done excellent service for a long time now by insisting on this. He believed that they had got to accept it like a problem in mathematics, as having one answer only. Probably there was also greater keenness on the part of some of these rivals to avail themselves of such advantages than was shown by young clayworkers in this country. Still British makers were alert to the wants of the times, and the fact remained that they had not been deluged with foreign retorts, although during recent years such retorts had been supported with great candour by two or three distinguished gas engineers. That testimony was undoubtedly as honest and sincere as it could possibly be, and the makers had undoubtedly profited by it. But there was also other evidence of a less favourable kind on the wing, which went to suggest the fallibility of German material, as well as clay material of any other and home manufacture, and to suggest further that if German makers were supplying this country with retorts in anything like the same bulk as British makers, the volume of complaint, whatever point it registered, would not be less than now. They acknowledged, and foreign makers were doubtless well aware, that, under the best regulated and most scientifically controlled system of manufacture, uncertain conditions frequently prevailed, and possibilities of fault and mischief arose which it was not always possible to foresee. The handling of fire-clays, particularly on a large scale and in heavy goods, necessarily carried these risks. He thought it was incumbent on them to make some allusion to the article on gas-retort manufacture published in the "Brick and Pottery Journal," on Nov. 2, and subsequently copied into the gas papers. Their general education was miserably useless if it gave them no power to resent the reflections which the article contained. For his own part, he was not at all forgetful of the fine spirit of industry by which some of their foreign competitors were stirred. The whole clay-working world was under an obligation to German chemists; and he should be the last man to scoff at foreign skill and the wide application of laboratory methods which they cultivated. But the writer of this particular article, purporting to reveal the failings of the makers, was either very ill-informed or wilfully misleading. The article was years behind the clock; and it was clearly their business to repel gross misrepresentations of what they were doing in 1912, when they were both untruthful and unfair. There was not in the whole article—and he had searched it carefully—well done in some senses as it no doubt was, one shred of information not already possessed by any really enlightened retort maker in Great Britain. Some of the suggestions which were commended as being juicy and novel, and probably devoured by some with more greed, and ranking as more juicy because they were of foreign origin—had been practised, and mostly superseded in England twenty or thirty years ago. The article reminded one forcibly of the Ox of Prometheus. It was backed as being sleek and well shaped, but in truth it afforded nothing to eat. The subject was altogether too big to thrash out on an occasion like this; but it might be taken that English and Scotch makers were not allowing the grass to grow under their feet. The result had largely been brought about by the Society of British Gas Industries. Men were said to languish in solitude; but the Society had brought them together, compelled them to hold useful and habitual intercourse with each other, united them in common ties and common effort, and given them a more intimate acquaintance with the wants of engineers. These things were not to be ignored. They were as big as they could well be with the promise of more enlightened efforts. He agreed, too, that they owed much to the Bywater manuscript, although if the author were to trot it out again, he would be the first to admit the necessity of amending the original text. Still it was charged with a great deal of inherent energy; and it was hardly less effective, because of the momentum it derived from other conspicuous sources. As to the standard specifications, they had been drawn up with good judgment and without being unfairly oppressive to either the weakest or the strongest members of the fire-clay trade. If this spirit continued to guide the Committee, confidence would continue. He had held from the beginning that the whole business was the first interest of firebrick makers themselves. It was difficult to see how any evil could possibly arise by first setting up useful and higher standards, and then, by compounding clays and training workers, to conform to them. There were no doubt many things in connection with gas manufacture more profitable, but none more fascinating. They were fully alive to the fact that the improvement of fireclay supply was an occupation they could not afford to neglect in times like the present. He thanked Mr. Perry for pointing out that they were pushing on the high road to a better era, and he believed that fireclay men were now prosecuting the industry in this country with a vigour and a resource which left no ground for complaint.

The Chairman said it occurred to him during the reading of the paper that this was a departure, and he was glad to find the members concurred in it. Some of the members were afraid that, if they read papers, they were going to give their own particular trade away, and so they did not expect they would have papers on their own particular manufactures. But Mr. Pearson-Perry had shown them how it could be done. They were glad to learn from any branch of their industry of the particular difficulties met with in it, and the scientific work that had to be done to produce good workmanship.

Mr. G. H. Timmis said the subject was, of course, one of very great interest, especially to those in the fire-clay business. It was a trade that was very much on its trial at the present time. So far as the new standard specifications were concerned, he had spent some considerable time in working at them experimentally; and he thought that, in all probability, it would not be very long before they found that some modifications were required. It was, however, all work in the right direction; and it had destroyed the old rule-of-thumb methods. Mr. Perry had clearly set forth some of the new processes that had been introduced for the purpose of meeting the new requirements. But there was one point to which he (Mr. Timmis) should like to refer. It was towards the end of the paper, where Mr. Perry spoke of the necessity of properly using the material when properly made. Now he (Mr. Timmis) would call the attention of the Refractory Materials Committee to this, and ask them if it was not possible to get gas engineers to extend their specification so as to include, in some measure, the proper application in both the erection and the user of these goods. He had had some experience of the fire-brick trade, and also of retort and furnace building; and he had always contended that he would rather use some inferior article if properly set than some of the best fire-brick badly set. He could assure those present that this was so. He did not mean carelessly set, but set with a proper scientific knowledge of what was being done. He especially referred to the use of raw clay. In putting in a retort-setting—say, for the sake of argument, the retort-stack was 20 feet high—there would be more than sixty courses of bricks in it, which meant sixty separate joints. These separate joints, if added together, would make probably another 10 to 12 inches of fire-clay. What happened if the fire-clay contained 10 to 12 per cent. of water? and it very often contained a large percentage of organic matter. This was not burned out until the material had attained a high temperature in working. The consequence was the whole mass sunk; and he believed those gentlemen who had had experience of retorts would bear him out when he said that in new settings it was the top retorts that failed, but it was not the top retorts that got the most heat. Therefore, there must be some other reason. The reason was that these top retorts were the ones that suffered most from the contraction of the bed. There was a further point on which they would bear him out. When the bed was set the second time, the retorts would last longer than the first time. This was because the furnace had sustained its full shrinkage; and it was then only the retort-setting, and not the furnace, that had to be considered. These were points the Refractory Materials Committee might consider, because these difficulties could be overcome. If a certain amount of grog was used in the fine state with the fire-clay, it would prevent all that; and he thought if engineers put this stipulation upon the fire-clay makers, they would probably adopt it. He had mentioned this to one or two gas engineers; and they had said: "By all means use it, but you will not charge us anything more." His answer was, if they were going to supply a superior article which was going to do more work, they were entitled to more pay.

Mr. Harold N. Davis considered Mr. Perry had performed one good service on behalf of himself and his fellow-members of the fire-clay goods industry, because he had proved to the users of fire-clay goods the difficulties with which the manufacturers had

to contend. This would in the future make them much more sympathetic in their dealings with these firms. There was one point that occurred to him (Mr. Davis) in regard to the manufacture of fire-clay goods—that while the manufacturers were now undoubtedly employing more scientific means and methods in the production of their goods than had been the case hitherto, it appeared to him as a user of certain classes of fire-clay goods of which many members present were also users), there was one fundamental factor in the production of fire-bricks that none of the makers had yet been able to overcome, or satisfactorily deal with. This was the question of shrinkage. It seemed to him the manufacturers of fire-bricks had not yet been able to control the shrinkage of fire-bricks. Of course, he was alluding to the use of fire-bricks of the smaller kind, as employed for gas-fires, cookers, and so forth. Every maker of these goods would agree with him that they had still very great difficulty owing to the enormous variety in the sizes of the bricks they received from the manufacturers. If some method could be devised to enable the manufacturers to absolutely control the shrinkage, the difficulties of the users of these special bricks would be greatly minimized.

Mr. H. JAMES YATES said he should like to emphasize his friend's remarks. The matter complained of caused the makers of gas-fires endless trouble and expense. They could never rely upon the same brick or radiants, or whatever they used made of fire-clay, coming out at all consistent in size. Sometimes they found them considerably larger than the models sent to the makers; and sometimes considerably less. If this could be corrected, it would save a great deal of waste and a great deal of annoyance to their customers. He was able to fully endorse all Mr. Davis had said to the meeting.

Mr. PERRY said, in reply to Mr. Cliff, he had no doubt that in future copies of the paper could be sent out in advance to the members. He quite agreed with all Mr. Cliff had said; and he thought that gentleman had spoken out well in the interests of the fire-clay goods manufacturers of this country. He felt quite sure that any gas engineer could obtain from the English makers any material that he required, and suitable for his work. He said this with 25 years' experience, and had every reason to believe that the material could be supplied without any question, and suitable in every possible manner. He thanked Mr. Timmis for his remarks; and he certainly thought the subject of use should be brought before the Refractory Materials Committee. As to the observations of Mr. Davis and Mr. Yates, he had no doubt the matter would be taken up by the trade. The type of goods to which they referred was almost a special line by itself. The very thinness of the brick required caused great difficulty, he understood, in the manufacture. He had no doubt, however, after the remarks that had been made, the manufacturers would take up the matter, and deal with it in a special way.

Mr. J. W. BROADHEAD, in moving a vote of thanks to Mr. Perry, remarked that there was no doubt the importation of retorts had wakened up the British manufacturer of fire-clay goods. It was, however, news to him that a retort-bench, after being fired up, contracted. His experience was that a retort-bench expanded. They would not mind the expansion if the bench would remain there; but unfortunately it contracted. He thought the fire-clay makers could now give them products that would not contract.

Mr. F. J. WEST, seconding the motion, said the same thought as that to which the Chairman had given expression had passed through his mind. It was good of Mr. Perry to give the members, including his friendly rivals, what were really secrets of the trade. This was another tribute to the Society of British Gas Industries, that it had created such a feeling among them that one member could come there and give his fellows the benefit of his experience. Mr. Perry's paper was another valuable addition to the record of the technical proceedings of the Society.

The motion was heartily passed.

Mr. PERRY thanked the mover and seconder very much for their kind remarks, and the members generally for their endorsement of them.

OPTICAL PYROMETRY IN GAS-WORKS.

The Stereopyrometer.

In the "JOURNAL" for the 3rd of September last (p. 621), an illustrated description was given of the "Lescole" pyrometer, which in outward appearance is like a telescope, and is used in a similar manner. Another type of optical pyrometer has recently been described and illustrated in "Le Gaz;" and M. Lelièvre, the Editor of that publication, and M. Léonce Fabre, of Marseilles, send the following particulars in regard to it. It is called a "stereopyrometer," from the fact that, as will be seen from fig. 1, it is a species of stereoscope.

The instrument has a slide furnished with two pairs of sight-holes sufficiently near each other to allow of an observation by one or the other pair as desired. In these holes are fitted two pairs of cells, filled with standardized solutions suitable for temperatures ranging from 550° to 2000° C. The absorbing powers of these solutions are selected so that all the light, no matter of what colour, emitted by a hot body is absorbed. The stereopyrometer is a direct-reading instrument. All that is necessary is to observe the instant the object appears visible with the red tint in the case of rising temperatures, or invisible with falling ones. The instrument can be used at a distance from the hot body; and consequently there is neither chemical change in the solutions nor deterioration of the apparatus through the heat.

The stereopyrometer may be employed either directly or by reflection; and it does not require any preliminary standardization, preparation, or accessories. For example, supposing it is desired to maintain in a setting a temperature of 900° C., the foreman would take his stereopyrometer fitted with 800° to 900° cells, and look at the setting with those for the lower temperature (see fig. 2). If it appeared of a phosphorescent grey, it would show that the temperature of 800° had not been reached. As soon as it was attained, however, the grey would change to red. Then the cells should be moved along, and the same observation made with a pair for 900°. When the red colour appears, the observer is sure that this temperature has been reached. The cells are interchangeable.

Fig. 1.

Fig. 2.

Advantages of High-Pressure Gas for Factory Lighting.—One of the papers read at the last meeting of the Irish Association of Gas Managers was on "High-Pressure Lighting"—the author being Mr. A. M'I. Cleland, an official in the Gas Department of the Belfast Corporation. In connection with the paper some interesting illustrations were given of high-pressure incandescent gas lighting in factories and workshops in the city; and the Gas Committee have now directed the attention of the consumers to these successful applications of the system of lighting referred to by the issue of an exceedingly effective collection of reproductions of photographs of a number of installations, accompanied by short descriptive particulars. Consumers who wish to know what high-pressure gas lighting is, what it means, and what it costs, will find answers in the pages of the pamphlet which has been issued by the Committee in the belief that an attentive study of the figures contained in it will convince manufacturers and merchants that "for economy, efficiency, and all-round reliability, lighting by high-pressure incandescent gas has no rival." The contrast presented in the pamphlet by ordinary flat-flame and inverted lighting and by the high-pressure system is very striking.

ROADS AND PAVEMENTS IN RELATION TO GAS SUPPLY.*

The gas manager's interest in roads and pavements at present runs chiefly in two directions. First of all, he is concerned with the roadway and pavement because all his mains lie embedded beneath them, and he is responsible for restoring them to their proper condition when he opens them for main-laying or repairing, or for putting in fresh service connections. Secondly, he is interested in road construction and repair, because there is scope therein for the employment of tar and pitch, to the advantage of the revenue derivable from the sale of these bye-products. The two books by American engineers which are before us deal generally with roads, pavements, and paving materials. Our comments on them will be restricted to the parts likely to be of interest to gas men in either of the two respects indicated above.

Mr. Tillson, in the course of his otherwise excellently compiled volume of 650 pages, has, however, little to say on the use of tar, perhaps because he is dealing primarily with city roadways. He says: "A pavement that is somewhat used in England where the traffic is light is called tar-macadam." This tar macadam he describes as consisting of "one ton of 1½ inch granite to 12 gallons of tar, 28 lbs. of pitch, and 2 gallons of creosote oil." This is certainly one form of tar macadam; but it is not that which has been so extensively used in recent years throughout this country. For the rest, we find scarcely anything further about tar or coal-tar pitch for roadways in the book. He uses the word "pitch" principally for mineral pitch or solid bitumen. He has something to say about different grades of creosote for impregnating wood blocks for paving, but in regard to American rather than English commercial creosotes. Some coal-tar pavements laid in Washington prior to 1887 appear to have been successful in some instances but not in others, and probably, in the light of present-day knowledge of the use of tar in road construction, such failures would almost certainly now be avoided. Mr. Tillson considers that the action of illuminating gas, as it sometimes escapes from leaky mains, is very detrimental to asphalt pavements. He says that the action of gas is generally made manifest by the appearance of a great many cracks or checks in the pavement, mostly lengthwise of the street, which, under traffic, soon become soft, and the pavement disintegrates. It seems likely Mr. Tillson has studied the effects of gas leakages in circumstances which scarcely prevail in this country—*i.e.*, with gas generally much richer in hydrocarbons than ours, and therefore having a greater softening action on asphalt. Though there is not much matter in Mr. Tillson's book which will directly appeal to gas engineers, there is a great deal that is otherwise interesting; and it is set forth in pleasant and lucid style.

Professor Spalding's book, of 408 smaller pages, contains less historical and theoretical matter than Mr. Tillson's more pretentious work. Its utility for reference purposes is marred by the lack of an index; whereas Mr. Tillson has provided an admirable one. Professor Spalding, however, gives a brief account of coal tar and water-gas tar, in his chapter on "Bituminous Macadam Roads;" and both there and in other chapters he refers to various specifications and tests of tars and other bituminous materials. In view of the wide scope and relatively small size of his text book, probably he has said as much about tar for road use as is appropriate, and that much is said well and seems quite trustworthy. Neither he nor Mr. Tillson appears to have considered it necessary to refer to the accommodation of gas and water mains, &c., beneath roadways and pavements.

* "Street Pavements and Paving Materials." A Manual of City Pavements: The Methods and Materials of their Construction. By Geo. W. Tillson, C.E., Consulting Engineer to the Borough President, Borough of Brooklyn, City of New York; Member Am.Soc.C.E.; Am.Soc. Mun. Imp.; &c. Second Edition, First thousand. New York: John Wiley and Sons; London: Chapman and Hall, Limited, 1912.

"A Text-Book on Roads and Pavements." By Frederick P. Spalding, Professor of Civil Engineering, University of Missouri, Member Am.Soc.C.E. Fourth Edition, Revised and Enlarged, First thousand. New York: John Wiley and Sons; London: Chapman and Hall, Limited, 1912.

TAR AS A SOURCE OF LAMPBLACK.*

The third edition of Dr. Hippolyt Köhler's work, on the manufacture of lampblack and other forms of carbon, constitutes a volume of Dr. Engler's series of "Handbooks on Chemical Technology," which bears on the gas industry in so far as many of the processes of manufacture of which it treats are dependent on tar and tar oils for their raw material.

The first chapter of the book gives general information on the properties and use of carbon; the second deals with the production and use of soot or lampblack; the third refers to black or carbon as a colouring agent for printers' ink, &c., and to animal charcoal or other carbon as a decolorizer of various liquid products; the fourth deals with the testing of the various forms of black, both in respect of composition and covering power.

It is unnecessary for us to refer in detail to the processes described by Dr. Köhler for the combustion of tar and tar oils for the production of black. Tar-works' chemists and managers may, however, glean much information from the book as to the relative values of different grades of tar and tar products for the manufacture of black. In the United States of America, natural gas is used to a large extent for the preparation of some of the finer qualities of black. In connection with this use of natural gas, Dr. Köhler compares the composition of natural gas and coal gas; but, unfortunately, he makes them more nearly alike than they are through what is obviously a transposition of the percentages of hydrogen and methane in coal gas. He states that gas from Westphalian coal contains 59·5 per cent. of marsh gas and 30·9 per cent. of hydrogen. This blunder should be rectified in the next edition, as should also the spelling of Roger Bacon's name as "Roger Baco," both in the historical chapter of the text and in the index.

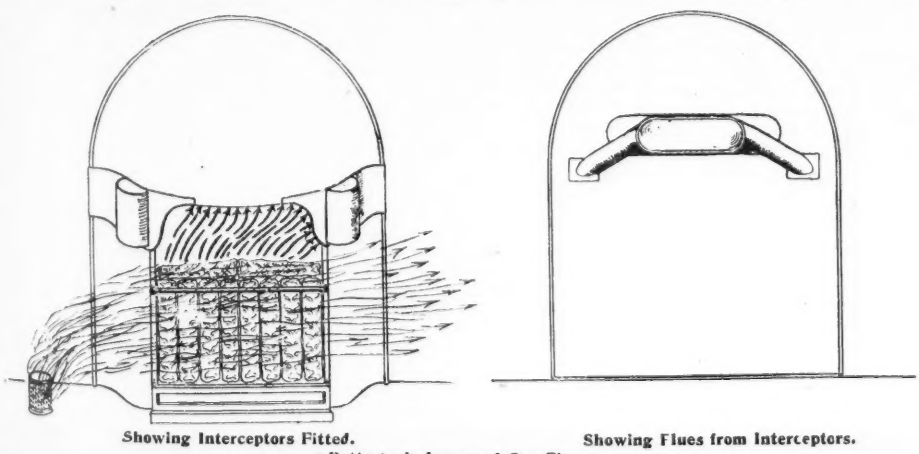
Dr. Köhler's work is one to be highly commended for the use of those who are interested in the subjects of which it treats.

* Die Fabrikation des Russes und der Schwärze, aus Abfällen und Nebenprodukten mit besonderer Berücksichtigung der Entfärbungskohle; von Dr. Hippolyt Köhler, Direktor der Rütgerswerke-Aktiengesellschaft, Berlin. Dritte gänzlich umgearbeitete Auflage, mit 114 Abbildungen im Text. Brunswick: Friedr. Vieweg und Sohn, 1912.

POTTERTON'S IMPROVED GAS-FIRE.

The practical mind of Mr. Thomas Potterton, of the Cavendish Works, Balham, leads him into all sorts of fields of investigation. He has been paying some attention to the question of the escape of products of combustion from beneath the canopy of a gas-fire; and, from his personal experience and research, he has come to the conclusion that the construction of gas-fires, and the pull of the chimney, are not in some cases the sole factors that govern immunity from such escape. His attention was first called to the matter by experiences with a gas-fire in a room subject, according to the direction of the wind, to draughts across the face of the fire. He had his suspicions that there was, through the cross currents of air, a slight escape of products from beneath, subject to the direction of the draught, one or other of the ends of the canopy; and he satisfied himself as to the existence of the cross draughts by the use of a little smoke-box, as shown in the first of the two illustrations.

Now Mr. Potterton holds that it would be an advantage to have gas-fires fitted in a manner that would effect the capture of any casually escaping products occasioned by cross currents of air; and he has devised an effective method of doing this. So convinced is he as to its utility that he is patenting the arrangement. There is no doubt about it that, if there is one place more critical than any other in this matter of escape of products, it is at the ends of the canopy. Therefore, what Mr. Potterton has done is to fix on the outside of the gas-fire a little ornament at each end of the canopy; and these ornaments form covers to small flues—one on either side. These secondary flues project just a little downwards, and then to the ordinary central flue at the back of the fire, as shown in the second illustration. The ornamental fitting is only about 3 inches deep, and the side flues are ¾-inch ones. Mr. Potterton's experiments assure him that the "suck" set up by the small side flues is sufficient to capture any products caused to escape through cross currents of air, or through any ill-design in the ends of the fire canopy. Existing fires can be fitted with the arrangement, as well as new designs.



Showing Interceptors Fitted. Showing Flues from Interceptors.

Potterton's Improved Gas-Fire.

LONDON AND SOUTHERN JUNIOR ASSOCIATION.

There was a well-attended meeting last Friday evening of the London and Southern District Junior Gas Association, at the Westminster Technical Institute, Vincent Square, S.W., to hear and discuss a paper by Mr. A. R. Griggs, of the Bromley works of the South Suburban Gas Company, on the "Measurement of the Flow of Gases in Mains by Means of the Pitot Tube." The paper, with a report of the discussion to which it gave rise, will be found on pp. 670-75.

The President (Mr. D. J. Winslow, Lea Bridge), at the opening of the proceedings, announced that 14 new members had been elected since the last meeting, which meant a total of 36 new members this session—bringing the membership roll of the Association up to 188. He added that the next item on the programme was a visit on Saturday, the 7th prox., to the works of Messrs. Thomas Glover and Co. and R. & A. Main, and said that, as this visit would be made in conjunction with the Junior Institution of Engineers, it would no doubt be a very large gathering indeed.

ILLUMINATION TOPICS.

It was a varied bill of fare that had been prepared for the meeting of the Illuminating Engineering Society, at the Royal Society of Arts, last Tuesday evening. Dr. Silvanus P. Thompson was in the chair. The *pièce de résistance* of the occasion was the report by the Hon. Secretary (Mr. L. Gaster) on progress made during the vacation. A *précis* of the report, which occupied half-a-dozen long slips of printed matter, must suffice.

School and Library Lighting.

First we heard, in connection with the Joint Committees on School and Library Lighting, the information that they have held a number of well-attended meetings during the vacation, and have done a considerable amount of work, though not yet in a position to present a formal report. In both cases the first step taken by the Committee was to draw up a list of points on which further information seemed desirable. The Committees then proceeded to consider each of these headings in turn. In the case of school lighting, it was thought advisable to divide the subject into two parts—natural and artificial lighting. Artificial lighting has received almost exclusive attention so far; but it is hoped to deal fully with daylight later on. Among the subjects discussed by both Committees have been the provision of sufficient illumination for reading; the kind of lighting best suited for various classes of work; and the best methods of avoiding glare. It is hoped very shortly to fix, tentatively, the desirable illumination for different classes of work. The provision of sufficient illumination and the avoidance of glare appear to be of special importance in school lighting. The Committee have embarked upon a special series of tests in order to gain direct practical experience on these matters. By the courtesy of Dr. Clay, various forms of shades have been fitted up and examined in a class-room at the Northern Polytechnic. The illumination on the desks and the blackboard has been adjusted experimentally, and measured in order to ascertain what the desired density should be. The Committee have now reached the stage of drafting a tentative series of recommendations; and it is proposed to equip two schoolrooms completely with gas and electric lighting (making model installations), before presenting the actual conclusions on which they are based. The London County Council have entered sympathetically into this investigation, and have placed at the disposal of the Committee two classrooms for the purpose.

Factory Lighting.

It will be remembered that one of the main features of the report of the Chief Inspector of Factories for 1911 was a report by Mr. D. R. Wilson on his inquiry into the illumination practices of factories. We dealt with this in the "Journal" pages in July last; and then acknowledged the value of the work. The report alludes to this inquiry, and points out the great influence this action of the Home Office must exert on the improvement of lighting conditions, and speaks of the recognition it affords of the value of actual measurements of illumination. Incidentally, it is mentioned that the new Indian Act relating to factories contains specific reference to illumination; so that, in deciding points that arise in that country, illumination data of a valuable description should be collected. In regard to factories at home, it may be remembered that, in reply to a question put by Mr. Arthur Lynch in the House of Commons on May 16 last, the Home Secretary consented to appoint a Departmental Committee with special reference to industrial lighting; and it is understood that this Committee will be appointed within the next month.

Accidents and Illumination.

The report contains a reference to the Official Convention, to the "Illumination" lectures that are being held at the Regent Street Polytechnic again this year, to the question of the illumination of mines, and to the subject of the design of miners' lamps. Then Mr. Gaster recounted the incidents of his travels this last summer on the Continent and to America in connection with the subject of illumination. He was present at the Congress for the Prevention of Industrial Accidents held at Milan at the end of May. It may be recalled that last year a noteworthy report was issued by a Departmental Committee on the prevention of accidents in factories. This contained special reference to illumination; and it was seen that, in the examination of witnesses, an effort had been made to trace a connection between defective lighting conditions and the frequency of accidents. At the Milan congress, Mr. Gaster read a paper on the value of good illumination as a means of preventing accidents, and another was read by Mr. V. B. Lansingh on behalf of the American Illuminating Engineering Society. One of the points that specially struck those present at the congress was the suggestion that, in the inquiries now proceeding, inspectors should make a practice of noting the conditions of illumination whenever an accident occurs, so that eventually data may be obtained tracing cause and effect. Another suggestion was that insurance companies should recognize the value of good illumination as regards safety and immunity from accidents, by granting specially favourable rates to those whose premises comply with a certain standard of good lighting. Special stress was laid on the importance of good illumination in the case of dangerous machinery. In Belgium, the question is on the move of bringing before the authorities a scheme for the promotion of a Government Commission on Illumination. Mr. Gaster expressed the hope that such a Commission will be formed, and that a similar step will ultimately be taken in other countries. All these commissions should be able to work in harmony, and keep in constant touch with each other.

An Illuminating Engineering Society for Germany.

Mr. Gaster seems to have done some good missionary work while abroad. When in Berlin he gave Dr. Hagen, of the Reichsanstalt, and Drs. Brodhun and Liebenthal an account of the work of the British Illuminating Engineering Society. The project of forming a German Illuminating Engineering Society was then being considered; and Professor Drehschmidt, representing the gas interests, promised to give the proposed Society his assistance and support. An official announcement has been made as to the starting of a Society. The Committee to settle the preliminaries have Professor Warburg, Director of the Reichsanstalt, as the President, Dr. E. Liebenthal as Secretary, and the Committee receive the assistance of Herr Dettmar, the Secretary of the Verband Deutscher Elektrotechniker, and Dr. Bunte, the Secretary of the Verein für Gas und Wasserfachmännern.

A Visit to America.

During his visit to America, Mr. Gaster was brought into touch with the illumination workers there; and they were delighted to hear of the progress that was being made in this country and on the Continent. In the United States those working in this direction are somewhat at a disadvantage, inasmuch as each State has its own officials and legislation. Consequently when soliciting attention in such matters as industrial lighting, it is essential to approach different people time after time. Any measures that can be taken in Europe are therefore eagerly awaited in the United States, since they afford a precedent which will doubtless influence the authorities in their country. The American Society are going to adopt the policy of the Society in this country, of trying to interest other outside bodies in their work—such as librarians, scholastic bodies, ophthalmists, and architects.

A Museum of Safety.

In New York there is a privately conducted Museum of Safety; Dr. Tolman being at the head. The museum is excellently equipped, but the housing is at present inadequate. It is understood that Dr. Tolman is shortly to receive fuller recognition at the hands of the authorities, and also that a section dealing with illumination is to be added. It is interesting to mention that the Home Office in this country have just decided to erect a museum of safety on similar lines; and it should be the duty of the Society to see that illumination receives a due share of attention.

A Primer on Illumination.

One enterprising step which has recently been taken by the American Illuminating Engineering Society is the issue of "A Primer on Illumination." This consists in an illustrated and readable pamphlet, containing a summary of some of the most simple and fundamental rules of illumination. This has been reproduced and circulated very widely in the United States, and Mr. Gaster has been asked to co-operate by arranging for the issue of a similar publication in this country. It is accordingly proposed to publish in "The Illuminating Engineer" a version of the "Primer," slightly modified to suit the conditions of this country, which will subsequently be reprinted. The subject-matter is applicable to all illuminants; and it is hoped that the distribution of this "Primer" will do much to spread abroad a knowledge of the illuminating engineering movement.

In Boston, Mr. Gaster had the opportunity of meeting Dr. Louis Bell, and in company with him examined the latest developments of street lighting, mainly by magnetite arc lamps. He also had a long interview with Mr. Wrightington, Vice-President of the Consolidated Gas Company; and he observed that trials are being made with high-gressure gas. In some of the cities of the United States (*e.g.*, Newark), what is termed the "Great White Way" movement has been vigorously pushed. Through the assistance of Mr. P. S. Millar, and through the courtesy of the local supply authorities, Mr. Gaster had an opportunity of observing such spectacular street lighting, the brilliancy of which in some cases

exceeds anything that he has seen in this country. On the other hand, there seems to be sometimes a disposition to flood the street with light without paying quite enough attention to the scientific aspects of illumination, so that the effect is glaring. The initial result of this movement has been to attract attention to certain streets, and to increase their commercial value. However, in some instances the merchants have found that the lighting of their shops appeared relatively dim in comparison; and it soon became necessary to increase their window lighting so as to be on the same scale as that in the public streets. In Philadelphia, there was an opportunity of visiting, in the company of Dr. H. E. Ives, the works and laboratory of the United Gas Improvement Company. The Company have taken the enterprising step of establishing an illuminating engineering research laboratory, and have placed Dr. Ives in charge. There are now quite a number of gas and electric companies in the United States that have established illuminating engineering departments.

At Home.

Since his return, Mr. Gaster has been present at the congress of the Textile Institute, many of the members of which recognize the great field for illuminating engineering in connection with textile works. The illumination of these intricate cotton-spinning and weaving machines is a most important problem; and there can be no question that the existing methods of lighting in many mills and factories might often be improved. In addition to this, there are special problems, such as the production of "artificial daylight" and the correct revealing of colour values, which are of vital importance to the industry. Subsequently, Mr. Gaster was present at the first annual meeting of the British Commercial Gas Association in Manchester, and was much interested in the scheme advanced for promoting co-operation between all sections of the gas industry. The step is a momentous one that cannot be passed by in an account of the important events of the last few months. He expressed the belief that the new movement, if wisely guided, will be productive of good, not only to gas, but to the lighting industry as a whole.

Presidential Recognition.

There were a few remarks by the President recognizing the work contained in the report of the Honorary Secretary. Dr. Thompson thought the Society might congratulate itself on their Honorary Secretary, and the success that had attended his vacation wanderings. It was not given to all of them to go almost from China to Peru in search of light. Mr. Gaster had been over the Continent and the United States always on the same mission. It was interesting and encouraging to them to learn that in all the countries visited, those concerned in illumination were finding, each country in its own way, the same interests and the same solutions to the problems that presented themselves. They had now in almost every civilized country the beginnings at any rate of an organization which would be prepared to co-operate with their own in the promotion of good lighting. The organizations that were growing up had been very largely modelled on the lines of their own. It was true the American Illuminating Engineering Society were earlier in the field; but, on the other hand, the British Society had been the pioneers as an Illuminating Engineering Society in organizing joint conferences—lectures in common, and discussions together—with other bodies such as architects, librarians, and school managers, discussing with them questions of lighting, and the effect in their particular institutions. In the various countries, they had now friendly co-operation and friendly rivalry. Each succeeding year, in their own experience, they found the subjects widening, and fresh interests coming up; and the Society were attaining to a position of greater influence year by year. He (the President) regarded it as significant that the British Government were appointing a Committee to look into this question of illumination, and equally significant was the report of the Chief Factory Inspector in that it contained such a substantial section devoted to lighting. He thought it was also an important suggestion for insurance companies that they should allow a lower premium or a greater rebate to those manufacturing establishments that were properly lighted, and where fewer accidents might be expected. It was obviously to the interest of the insurance companies to diminish the number of accidents; and it was also to the interest of the manufacturers to put the lighting of their establishments in good order. These were all evidences of sound progress on the lines desired; and they would give the members strength.

Ancient Lamps.

A large number of ancient lamps were on view—part of the famous collection of Mr. J. W. Johnston; and this gentleman next afforded the members a vast amount of interest by diverting attention from present-day illuminants to the specimens of the actual forms of lamps used before gas was distributed through our streets, and as far back as a period 200 or 300 B.C. There was hearty thanks to Mr. Johnston for the opportunity he had given for seeing the samples of his unique and valuable collection, and for the information afforded in regard to the lamps. In happy terms, Mr. F. W. Goodenough proposed the vote, and Dr. Levy seconded it. Mr. W. J. Liberty called attention to the fact that there were centrally hung lamps in the City burning candles in years long since; so that the present-day centrally hung lamps could not claim to be the first so suspended for illumination purposes in the City streets. He also expressed the view that a collection of the early forms of street-lighting lamps, with a paper on them, would be very interesting to the members.

A New Illumination Photometer.

The succeeding item on the programme was a description of a new illumination photometer that Mr. Hadyn Harrison had devised. This gentleman pointed out that he had, as the members knew, obtained a photometer which would read low illuminations. This new photometer had a very long scale; and it would read from 10 foot-candles down to an extraordinarily low figure. What was wanted was to be able to measure light that was the nearest approach possible to darkness. For instance, in a long country lane, where the lamps were wide apart, and small units were used, if they wanted to tell what was the amount of light between the lamps, in the fraction of a foot-candle, they could not do it with the instruments at present in use. But with this one they could; and, with the same instrument, they could work up to 10 foot-candles, which was above what they need trouble about in street lighting. He used in the photometer the principle of an electric lamp and varying the current.

Photography and Photometry.

Mr. J. S. Dow addressed the meeting on this subject, and explained his views by good and bad photographs taken by artificial lights. He considered that the question of photographic illustrations of artificial lighting was in these days a vital one to those concerned in illumination. What it was necessary to show in the picture was the exact effect of the light. As time went on, he thought the importance of really good photographs by artificial light would be still more strongly felt. But there was great difficulty connected with the production of such photographs; people seemingly having very little idea as to how to obtain a good picture by artificial light. In his opinion, photometry and photography ought to go together. It was better to be able to measure first the brightness of things where the photograph was being taken, in order to find out what exposure ought to be given, in order to obtain a good picture. He and Mr. Mackinney had been working in this direction; and though there were many difficulties, the pictures he would show on the screen would illustrate the fact that they had secured a fair measure of success. [The pictures did.] The chief essential in a photograph was that they should get the room or other place to appear in the picture precisely as it did to the eye. It was only by getting the particular requisite exposure, and carefully selecting the development, that anything really good could be obtained. In comparing two systems of lighting, photography was fallacious unless the conditions were quite equal.

The other item introduced to the notice of the meeting had reference to miners' lamps. Thanks were extended to all who had contributed in any way to the interesting evening that opened the new session.

The Sale of Residuals in Germany.—The "Wirtschaftliche Vereinigung Deutscher Gaswerke, A.-G.," of Cologne, the Syndicate which controls the sale of residual products in Germany, and to which the majority of gas-works there belong, announces—in continuation of its organization of the coke industry—important amalgamations with the wholesale coal concerns, which deal also in coke, of South Germany and Switzerland, and also of Bavaria and the Tyrol. The new Syndicates will be called "Bayerische Gaskoks-Vertriebs-Gesellschaft m.b.H.," Munich, and "Süddeutsche Gaskoks-Vertriebs-Gesellschaft m.b.H.," Mannheim. The continually increasing demand for coke for industrial and heating purposes has necessitated measures being taken for the regulation of its sale. Although several large towns in Westphalia are now taking their gas supply from the coke-furnaces, and have closed-down their gas-works, yet the supply of coke from the other gas-works is constantly increasing, and is likely to be equal to the demand. But these new steps have been taken mainly in order to regulate the prices.

Corrosion of Lead Pipe.—Lead pipe corrosion of a somewhat unusual nature was observed on some sections recently uncovered in the grounds of the Technical High School at Charlottenburg. The pipe has been in the ground for about 24 years; part of it being unprotected, and part embedded in a cement foundation. The unprotected portion was found to be in a practically perfect state of preservation; but the other part showed a peculiar transformation. The contact between the pipe and the cement was not uniform, and where the pipe entered the mass the lead was transformed into a hard, compact, yellow-red substance. When this was removed, and a section of the pipe not affected in this way was exposed, the latter was found to have a scarred surface, with silver-white lustre, which rapidly changed to a dull grey in the air. The pipe was 0·7 inch in diameter, and about 0·2 inch thick. An examination of the affected section showed the transformed mass to be made up of concentric alternating red and yellow layers, 24 red and 23 yellow, or one pair for each year the pipe lay in the cement. Analysis showed the two substances were the low and high oxides of lead (PbO and Pb_3O_4); and the supposition was that the seasons influenced the formation of the oxides. Thus during the months of high precipitation more active oxygen would be present which would result in forming the higher oxide (Pb_3O_4), while the lower one would be deposited in the drier season.

THE MEASUREMENT OF THE FLOW OF GASES IN MAINS BY MEANS OF THE PITOT TUBE.

By A. R. GRIGGS, of the Bromley Works of the South Suburban Gas Company.

[A Paper Read before the London and Southern District Junior Gas Association, Nov. 22.]

The Pitot tube for the measurement of the motion of fluids was first brought before the engineering world in 1732 by M. Pitot, its inventor, who gave it the working formula of $V = K\sqrt{2gH}$, in which the factor K was unity and unvarying. For some considerable time, however, doubt was expressed as to whether this formula was the correct one; some experimenters holding that $V = \sqrt{gH}$ would give the true velocity, on the following grounds: When a stream of gas impinges on a plain surface at right angles to the flow, the theoretical relation between the resulting pressure in feet of gas and the velocity of flow would be expressed by the formula $H = \frac{V^2}{g}$; and this would be the reading given by the facing tip of the Pitot tube. Experiments prove, however, that a gas impinging upon the end of the facing tip does not lose the whole of its momentum parallel with the axis of the tube, but that $H = \frac{V^2}{2g}$; so that the correct velocity of flow from the Pitot tube reading would be given by the formula $V = \sqrt{2gH}$.

Having occasion, in the course of some tests on our carburetted water-gas plant, to ascertain the total quantity of air that was being used for blowing purposes, and only having a Venturi meter fitted to the generator blast, I determined to apply the Pitot tube for measuring the total quantity that was being delivered to the set. As there is very little information available on the Pitot tube, I thought it would provide a good opportunity to carry out some experiments with this instrument, in order to ascertain its suitability for the purpose of gas measurement. Later on, I was able to supplement the results arrived at with some further experiments carried out on the works gas-mains. The fact that in both cases I had means of checking the Pitot tube against meters enabled me to test several forms of tubes with a view of finding out the best design for the measurement of high and low velocity gas. On the air-blast main, I was able to obtain velocities up to 35 or 40 feet per second; while the works gas-mains provided me with low velocity flow. It occurred to me that a description of these experiments, and of the results arrived at, would prove interesting to the members.

It will perhaps be as well at first to describe the Pitot tube as used for measuring the velocities of gases. In its simplest form, it consists of a U-tube, both limbs of which are connected to the main under test. The end of one limb is bent round so as to face the current of gas flowing in the main, and forms the facing tip, or Pitot tube proper; while the other limb just enters the main at right angles to the flow, and is called the static-pressure tube of the combination. Fig. 1 shows the arrangement of the tube attached to a main. Now if a current of gas flows in the main, a certain pressure will exist, depending upon the amount of back-pressure at the end of the main and the quantity of gas flowing.

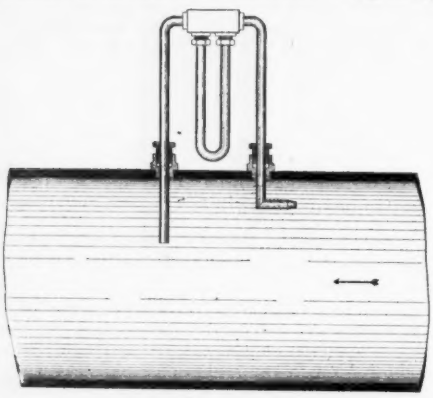


Fig. 1.

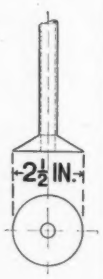


Fig. 2.

This static pressure will be transmitted through the left-hand limb to the surface of the liquid in the gauge. In the other limb —that is, the one facing the flow of gas—there will be a pressure equivalent to the static pressure in the main *plus* that due to the dynamic energy of the moving gas. The static pressure will thus act on both sides of the liquid in the gauge, and will balance-out, leaving a pressure due to the velocity of the gas which hereafter we will call the velocity head, or M. From the velocity head thus indicated the velocity of the gas may be ascertained from the well-known formula for falling bodies, $V = K\sqrt{2gH}$, where V = the velocity in feet per second, K = a constant, g = the acceleration due to gravity = 32·16, and H = the head in feet of the gas or liquid being measured.

Having found the mean velocity from the preceding formula, it only remains to multiply the result by the cross-sectional area of the pipe at the point where the Pitot readings were taken, to arrive at the quantity of gas flowing per second. A form of tube somewhat similar to fig. 1 was first tried on the blast-main; but the ends of the tube were connected to a more sensitive gauge, which I will describe later. By checking this tube against the Venturi meter at different rates of flow, it was found to have an increasing error as the velocity of flow increased. In other words, the factor K did not have a constant value, but varied with the different velocities. It appeared that while the Pitot tube itself accurately registered the static head *plus* the velocity head, the inductive effect of the air flowing across the end of the static pressure tube caused an additional increase in the apparent velocity head reading on the gauge; and this increased as the rate of flow increased. The result of a series of tests on various forms of static pressure tips showed that one similar to fig. 2 completely overcame this aspirating action. The value of K in the formula for this modified form of tip will then have a constant value for all velocities generally met with in air or gas mains.

This form of tube was, however, discarded for a more self-contained arrangement, as the tube was inconvenient to use; for, besides requiring two holes to be drilled in the main, one hole had to be made sufficiently large to allow the special tip on the static pressure tube to enter the main. In deciding upon a suitable design of tube, I thought it advisable to use one whose factor K, besides remaining constant, would have a value of unity, rather than one which necessitated a large correction factor. Tubes that exaggerate the reading of the velocity head are sometimes employed in order to facilitate the reading of the gauge; but very complete calibration of the tube is necessary at all velocities that are likely to be measured, in order to ascertain the values of K at these different rates of flow, or, in other words, whether K remains constant or varies in a definite ratio. The construction of a tube with a factor approaching unity and unvarying for all velocities, would mean the elimination of all likely sources of error in measuring the velocity head.

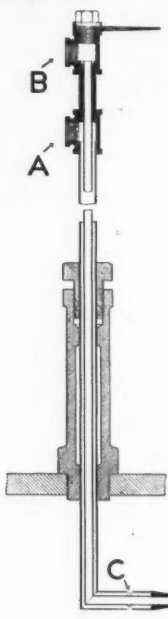


Fig. 3.

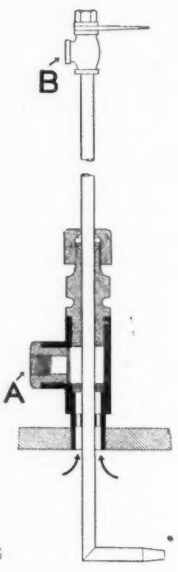


Fig. 4.

Two other types of tubes were therefore constructed and tested. They are shown in figs. 3 and 4. In both designs the static pressure tube was of entirely different form; the aim being to reduce the inductive effect of the flow of air to a minimum. The value of the constant K for the two tubes was within ± ·01 of unity, and remained practically constant for all velocities up to 40 feet per second. It will be seen that in both designs of tubes provision is made for the facing tip of the Pitot tube sliding in or out of the main under test. The reason for this is that the velocity of flow of a gas through a main is by no means constant throughout its cross section, but varies from a maximum at the centre to a minimum at the circumference, where, theoretically, the velocity is zero. It is therefore necessary to take readings of the velocity head at different positions in the main, in order to obtain the mean velocity. It appears from a large number of tests that the mean velocity of flow is at a point 70 per cent. of the radius of the pipe from the centre, but that this position is influenced to some extent by two factors—the presence of eddy currents in the flow, and the size of the Pitot tube that enters the main. To the latter point, I shall refer presently.

When it is desired to ascertain the velocity of flow in any particular main, a point should be selected in a straight run of pipe, and removed as far as possible from any causes which are likely

to have effect on the flow. The hole in the main to take the tube should be drilled and tapped exactly perpendicular to the axis of the pipe. After having accurately determined the internal diameter of the main, and made a note of any liquid lying in the bottom of the same (which restriction of area must be deducted from the gross area), the Pitot tube is inserted and readings taken on the gauge to which it is connected. If it is required to make a very accurate test, the main should be divided into a number of concentric areas, the number depending upon the size of the main and the degree of accuracy required. Readings should be taken at the centre of each annular ring; and as the square root of the readings is proportional to the flow, the average velocity is ascertained by taking the average of the square roots of the readings obtained.

In the tube shown in fig. 3, the Pitot tube proper is surrounded by another and larger tube, tapered at one end to the same diameter as the facing tip of the Pitot tube. Some small holes C are drilled round the larger tube, so as to connect the surrounding gas with the space between the two tubes. This space is connected with the static pressure side of the gauge by a T, marked A; and with the above arrangement the static pressure is correctly obtained, providing the holes C are not larger than 0·04 inch. The inner, or Pitot, tube is connected at B with the other side of the gauge. The whole arrangement slides through a stuffing-box screwed into the main, and is provided with an indicator to set the facing tip exactly parallel with the flow.

After experimenting with the two tubes for some time, the one shown in fig. 4 was finally adopted for the determination of the air supply to the plant—partly for the reason that this tube enabled a more accurate reading to be obtained on the gauge, as it did not seem to cause so much oscillation as did the other combinations of tube. This oscillation in the main gave considerable trouble with the first two tubes that were tried, and on investigation was found to be mainly due to sudden changes in the static pressure, and not so much to the varying rates of flow as was first thought to be the case. It appeared that under certain conditions of load and steam pressure a considerable amount of hunting of the turbo-blower governor took place, which, though not affecting the air pressure gauge on the main to by more than ½ inch of water, made it very difficult to obtain a reliable reading of the true velocity head on the extremely sensitive micro-manometer that was being used in conjunction with the Pitot tube.

To return to the tube shown in fig. 4, it will be seen that the static pressure is taken from the end of the ¾ inch nipple that screws into the main. This is probably the best position for taking the static pressure when there is any rapid oscillation present in the main; and for all velocities up to 35 feet per second there appears to be no aspirating action at all across the end of the nipple. A ¾-inch T screws on to the nipple, and is provided with a packed gland at the other end, through which the Pitot tube slides—thus allowing of exploring right across the main with the facing tip. The branch A of the T is fitted with a nose-cock, from which a flexible tube is taken to the static pressure side of the micro-manometer. The Pitot tube is made of ¼-inch brass pipe, one end of which has a right-angled piece screwed on to form the facing tip, and the other end B is connected with the opposite side of the micro-manometer.

It will, perhaps, be as well at this stage to describe the micro-manometer employed for measuring the velocity heads given by the Pitot tube. At the outset, I might say that it requires a gauge of extreme sensitiveness for measuring the velocity generally met with in air and gas mains. For instance, the velocity head produced by 5000 cubic feet of air flowing through a 22-inch main per minute, which is equivalent to a velocity of nearly 32 feet per second, is only 0·229 inch of water, or just over 2-10ths. It will be seen, therefore, that a very sensitive gauge indeed is required to detect small changes in the quantity passing.

After experimenting with various forms of gauges, I succeeded in constructing one capable of detecting so small a variation of pressure as 1-5000th of an inch of water. Of course, it will be understood that a gauge of this sensitiveness can only be used with advantage when the velocity of gas is fairly steady and free from serious eddy currents, liable to set up oscillation.

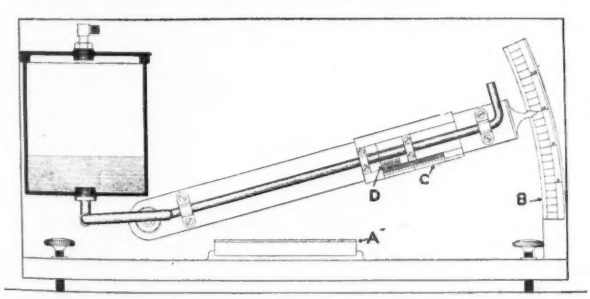


Fig. 5.

Fig. 5 shows the design of the gauge. The principle is essentially a U-tube; but one limb is inclined at an angle from the vertical. The other limb, it will be seen, is composed of a cylinder or reservoir, about 4 inches diameter. The inclined limb is of ⅛-inch bore glass tube, and is attached to a pivoted arm, which is provided with a pointer moving over a scale marked off in degrees which the tube makes with the horizontal. This admits of the glass tube being fixed at any desired angle, and so obtaining any desired magnification; for as the angle which the glass tube makes with the horizontal is decreased, so will the travel of the liquid column in the tube increase for any given vertical height. I find 5 or 6 degrees from the horizontal to be the smallest angle that can be used, as the capillary action of the alcohol (which is the liquid employed) prevents a definite zero being obtained. For most work, I prefer to use an angle of 10 or 15 degrees from the horizontal.

A very small lowering of the liquid level in the reservoir will produce a considerable alteration in the length of the liquid column in the inclined glass tube; so that for all practical purposes the lowering of the liquid in the reservoir may be ignored, and the total liquid column ascertained directly in the glass tube. This makes it far easier to read the gauge when any oscillation is present; and a mean reading can be satisfactorily obtained, as it is only necessary to take into account the level of the liquid in the one limb. Alcohol is the liquid used in the gauge, to avoid capillary action as much as possible; its specific gravity being ·8. The equivalent water column is obtained from the alcohol column in the inclined limb by simply multiplying the latter by ·8, and by the sine of the angle which the glass tube is found to make with the horizontal.

The gauge is provided with a spirit-level A, to which the zero of the scale B is set; and before using the instrument it must be carefully levelled by means of the adjusting screws provided at each of the corners of the stand. The moveable arm to which the glass tube of the gauge is attached is provided with a sliding-scale C, divided into inches and 1-40ths of an inch, so that 1-200th part of an inch of water can be read off directly at an angle of 15 degrees; and by means of a vernier D and microscope (which latter instrument, to avoid complication, is not shown on the illustration), a difference of 1-5000th part of an inch can be detected. It is necessary, after having levelled the gauge and decided upon the angle to which the inclined limb is to be set, to adjust the zero of the moveable scale C to the liquid level in the glass tube. Connection can now be made with the Pitot tube; the reservoir being connected to the facing tip of the tube, and the inclined limb to the static pressure side. The gauge will then indicate the velocity head produced by the flow of air or gas in the main—the static pressure, acting on both sides of the gauge, balancing one another.

I have devoted a considerable part of this paper to describing the Pitot tube, and the measuring instrument for same, because upon the design of the former, and the accuracy of the latter, the success of any experiments depend; and not until all chances of error are eliminated can the Pitot tube be depended upon to give reliable readings.

Having constructed a satisfactory tube for the purpose of measuring the air supply to the plant, it was necessary to ascertain the value of the constant K in the equation $V = K \sqrt{2gH}$ for the particular tube employed. As I have mentioned before, the blast main to the generators is provided with a Venturi meter, which permitted checking the tube when all other blast-valves were closed. To do this, the blast-valve of the generator was manipulated so as to give various rates of flow, and simultaneous readings taken on the Venturi meter gauge and the Pitot tube gauge. From the quantity of air passed by the meter, the velocity in feet per second was determined. The following is a sample calibration of the tube shown in fig. 4:

Internal diameter of pipe, 21⅜ inches.

Area, 2·61 square feet.

Blast pressure, 16 inches.

Temperature of air, 62° Fahr.

Weight of 1 cubic foot of air at temperature and pressure in main = 0·0789 lb.

M or velocity head by Pitot tube = 0·0808 inch of water.

Volume of air passed, by Venturi meter, per minute = 2894 cubic feet, which equals a velocity of 18·46 feet per second.

$$\text{Now } V = K\sqrt{2gH}$$

$$\therefore K = \frac{V}{\sqrt{2gH}}$$

To convert the reading M to the equivalent head of gas in feet, the velocity of which is being measured, it is necessary to multiply M by the ratio of the densities of the gauging liquid and the measured gas. That is,

$$H = \frac{M \times w}{a \times 12}$$

where w = weight of 1 cubic foot of water = 62·4 lbs. and a = weight of 1 cubic foot of air at temperature and pressure in pipe = 0·0789 lb.

$$\therefore K = \frac{18{\cdot}46}{\sqrt{64{\cdot}32 \times \frac{{\cdot}0808 \times 62{\cdot}4}{0789 \times 12}}}$$

$$= \frac{18{\cdot}46}{\sqrt{64{\cdot}32 \times 5{\cdot}325}}$$

Taking logarithms

$$= \log. 18{\cdot}46 - \frac{\log. 64{\cdot}32 + \log. 5{\cdot}325}{2}$$

$$= \bar{1}{\cdot}9989$$

Delogarizing, we get 0·997, which is the value of the constant K.

Having calibrated the tube at different velocities, in order to ascertain whether the factor K remained constant, traverse tests were made on the main when blowing a uniform volume of air, so that the position of the tube could be found where it would indicate the correct mean velocity. This was necessary, as it would not be convenient to make traverse tests every time the volume of air passing was required; and in this case I had reasons to doubt whether, by placing the facing tip at 70 per cent. of the radius from the centre, it would give the correct mean velocity. Subsequent tests proved that for this particular main the facing tip should be placed at 65 per cent. of the radius, in order to measure the correct mean velocity; the reason for this being the disturbing influence of the fan inlet to the main, which was not very far distant from the Pitot tube.

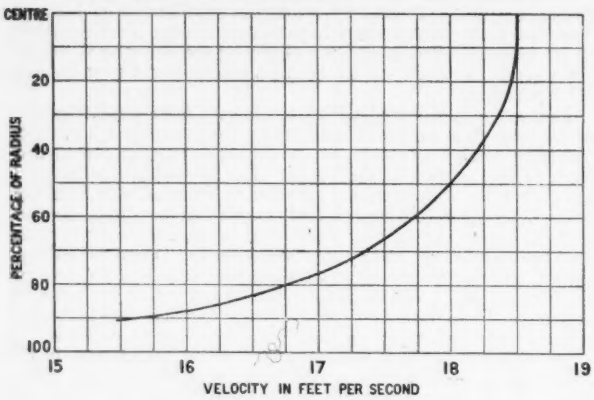


Fig. 6.

Fig. 6 is a graph of a traverse test made on the main when passing 2760 cubic feet of air per minute, which is equal to a velocity of 17·6 feet per second. The positions of the facing tip are given as percentages of the radius of the pipe from the centre, and are measured off vertically; while the velocity in feet per second is marked off horizontally. Plotting off the velocities for the different positions of the tube results in the curve shown. It will be seen that the velocity increases rapidly at first, as the facing tip is moved away from the circumference, and then more slowly, as the centre of the main is approached, where it reaches its maximum value, after which it will fall off again as the opposite side is neared. If the flow is free from eddy currents, the curve for the other half of the diameter should be somewhat similar to the one shown. But it is advisable when the velocity is at all high, or there are any bends or obstructions in the pipe line, to make a complete traverse of the diameter; and it is even necessary, in some cases, to make traverse tests in two directions, at 90 degrees to one another, to eliminate these disturbing factors.

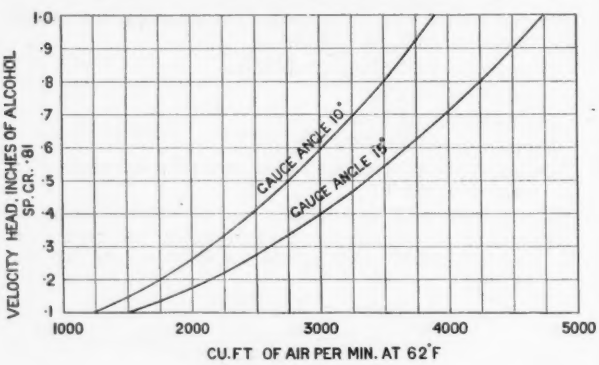


Fig. 7.

The similarity of the curves for the two halves of the diameter, besides depending upon the presence of eddy currents, is dependent also upon the Pitot tube itself, the size of which exercises an important influence upon the shape of the whole curve. The point of maximum velocity with a relatively large tube, instead of being at the centre, is always at a point beyond the centre from the point of entry of the tube. This has the effect of distorting the curve somewhat; but it can be overcome by using a small diameter tube, so that the space occupied by the tube shall be relatively small as compared with the area of the pipe. If this condition be fulfilled, then, with a perfectly steady flow, the curve approaches that of an ellipse. If the average of the velocities given by the Pitot tube at the different positions is taken, the position of the facing tip, where the average velocity will be indicated, can be found by the aid of the graph of the plotted velocities. Having placed the facing tip on the mean velocity radius thus found, all it is necessary to do when the volume of air passing is required at any time is to read the velocity head on the gauge and refer to a chart I hung up near the instrument, which gives the volume of air passing, in cubic feet per minute, at 62° Fahr. and the barometric pressure at 30 inches. A copy of the chart is shown in fig. 7.

For the sake of comparison, I have inserted a curve for the 10 degrees setting of the gauge, which very clearly shows the increased sensitiveness of the instrument with the smaller angle. In this chart the velocity head, in inches of alcohol, is marked off vertically; while the quantity of air in cubic feet per minute is marked off horizontally, It is assumed to be measured at a temperature of 62° Fahr. and a barometric pressure of 30 inches of mercury. It is necessary, however, to make a correction for two factors that are liable to variation—namely, the temperature of the air and also its pressure within the main—as these will both affect the weight of 1 cubic foot of air.

The curves are plotted from the formula

$$V = \sqrt{2g \times \frac{M \times 62{\cdot}4}{{\cdot}076 \times 12}}$$

where M = the velocity head in inches of water
= for 10 degrees setting, 0·1406 of velocity head in inches of alcohol
and = for 15 degrees setting, 0·2096 of velocity head in inches of alcohol.

The result multiplied by 60 and by 2·61, the area of the pipe, will give the quantity of air passing in cubic feet per minute, or, simplifying the formula, and taking logarithms,

$$\text{Quantity in cubic feet per minute} = 4{\cdot}0165 + \frac{\log. M}{2}.$$

Before passing from the subject of the measurement of air, I would draw attention to some tests of various forms of static pressure tips I have made, and to which I referred at the beginning of the paper. It has already been pointed out that the static pressure tip of the tube is liable to introduce a large error if attention is not paid to its design. With a view of finding out the best form of tip, I constructed four different types, and tested them at velocities of 10 to 35 feet per second, in the following way: The Pitot tube shown in fig. 4 was used; the different tips to be tested being screwed on in place of the facing tip. Connection was made, by means of the T B, with one side of the micro-manometer; the opposite side being connected with the branch A of the ¾-inch T. The true static pressure was assumed to be given at the circumference of the main by the ¾-inch nipple, which screws into the same—special precautions being taken to minimize the induction of the air across the face of the nipple.

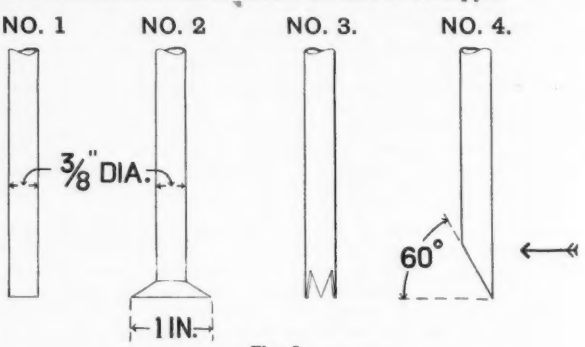


Fig. 8.

The forms of tips tested are shown in fig. 8. It will be seen that tip No. 2 is similar in design to the one already referred to, and shown in fig. 2. The latter is really an improvement on the one tested; the disc being of larger diameter, which resulted in a complete elimination of the induction error. The remarkable results obtained from these tests are clearly shown by the curves for the various tips in fig. 9.

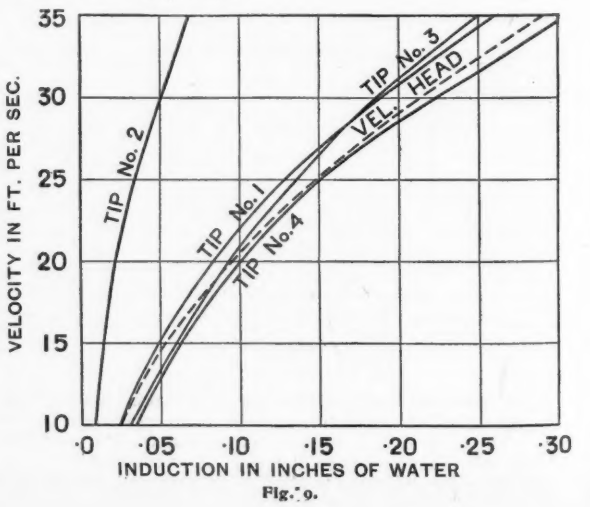


Fig. 9.

Here the velocity, in feet per second, is marked off vertically, and the induction set up by the tip in inches of water is measured off horizontally. Tip No. 2, it will be seen, stands alone as an effective means of reducing induction. This tip is 1 inch in diameter, which, according to its curve, is not large enough to eliminate the induction entirely. It was therefore enlarged to 2½ inches diameter; and this modified tip, referred to as fig. 2, was found to be quite accurate when checked against the static pressure opening of the tube shown in fig. 4, providing the flow is exactly parallel with the face of the disc. This tip was further checked by setting it up in a current of air issuing freely from the end of a pipe into the atmosphere. If there is no induction with the tip, the reading on the gauge to which it is connected should correspond with the pressure of the surrounding atmosphere, as the current of air has lost its potential energy, which has been converted entirely into the kinetic form. This was found to be the case when the tip was tested in a current of air the velocity of which was increased up to 43 feet per second. Incidentally, it may be remarked, this proves the accuracy of the static pressure opening of the tube in fig. 4.

The curves for the tips Nos. 1 and 4 show that the induction increases in almost the same ratio. Tip No. 3 represents a new form I designed for the purpose of reducing induction; and it was hoped that this tip would fulfil its object as the one shown in fig. 2 has, for this would mean the removal of the objection attached to the latter—namely, the large diameter of the hole required in the main for the insertion of the tip. How far this has been accomplished, can be judged by its curve, which shows that it only takes third place, although as the velocity increases its results improve. Anyhow, the results prove that a tip to the design of fig. 2 is the only satisfactory form to use if the static pressure is to be taken by means of a tube entering the main as in fig. 1. How far the true velocity head is affected by the induction set up by the above tips can be judged by the dotted curve I have plotted on the chart, which represents the velocity heads given by the facing tip of the Pitot tube at the different velocities at which the static pressure tips were tested. It will be seen the effect of using tip No. 1, 3, or 4 would be that the velocity head recorded would be about double the true velocity head that any velocity (within the limits of those tested) should produce.

I think I have now said sufficient to emphasize the necessity of taking every precaution to obtain the correct static pressure if the readings of the Pitot tube are to be relied upon. My remarks and experiments make quite clear the sources of error to avoid; and if these points are looked to, and one of the designs of tube shown is used, there is no reason why the instrument should not be relied upon to give accurate measurements of the quantity of gas flowing in a main, even though a calibration of the same *in situ* is impossible. This brings me to the measurement of velocities in gas-mains, to which I will briefly refer. We are now treading on more familiar ground; but I may add that these experiments on the air-main have provided a good deal of useful information. Though air was the fluid experimented on, it does not depreciate in any way the value of these results; and they are all applicable to the flow of coal or carburetted water gas in mains. The main upon which the tests were carried out was the outlet from the large purifying plant; the gas passing through a straight length of pipe to the station meters. By shutting off the other section of the purifying plant, and also one of the meters, it was possible to pass the whole of the gas through this pipe, and accurately to measure it by means of the one meter in use. It was not possible, however, to get a velocity of more than 10 feet per second on the main (representing 80,000 cubic feet per hour), on account of the purifying plant. This maximum velocity would only produce an equivalent velocity head of about 0·012 inch of water. Here the micro-manometer I have already described, with its refinements, was able to be used with advantage, as in this case, although the velocity was extremely low, the flow was perfectly steady, which enabled very exact readings to be taken on the gauge with the aid of the vernier and microscope.

In the first place, let us see how the working formula of the tube is affected by the measuring of gas instead of air. Of course, it will not affect the original formula, $V = K\sqrt{2gH}$; but, as I have already pointed out, H, or the head in feet of the gas being measured, is calculated from the velocity head in inches of water as given by the Pitot tube, by multiplying it by the ratio of the specific gravities of the gauging liquid and the gas being measured. As coal gas is only about half the weight of air, it is here that the formula will be affected; but apart from this, it will be exactly the same.

The modified formula will then be

$$V = \sqrt{2g \times \frac{M \times w}{D \times 12}}$$

Or, simplifying it,

$$V = 18{\cdot}288\sqrt{\frac{M}{D}}$$

Where D = the weight of 1 cubic foot of gas at the temperature and pressure in the main.

The other notations being the same as those of the air formula.

Where the specific gravity of the gas is likely to vary within wide limits, such as would be the case if a mixture of coal and carburetted water gas was being sent through the main, it would be necessary to ascertain the density of the gas at the time of taking each test, and correct to the temperature and pressure in the main, in order to arrive at the correct weight per cubic foot. Both designs of tubes shown in figs. 3 and 4 were used, and both were found to give satisfactory results. But the latter tube, I consider, is the safer to use, if there is a likelihood of there being any suspended matter in the gas, as the static pressure opening is not so liable to block up as the small holes in the former tube. But this is only recommended for velocities under 35 feet per second.

I have already referred to the effect of the Pitot tube itself on the position of the point of maximum velocity; and the result of numerous traverse tests carried out on the 20-inch gas-main fully bear out my statement.

The result of a typical traverse is shown in fig. 10. Here the position of the facing tip in relation to the centre of the pipe is marked off vertically, while the resulting velocities are marked off horizontally. This was with a half-inch tube; and the curve very clearly shows the effect of the tube itself in distorting the ellipse somewhat, and causing the maximum velocity to be at a point 20 per cent. of the pipe radius from the centre, on the opposite side from that which the tube enters. That this result is caused by the tube itself is proved by the fact that the smaller the tube is, the nearer is the maximum velocity to the centre of the pipe.

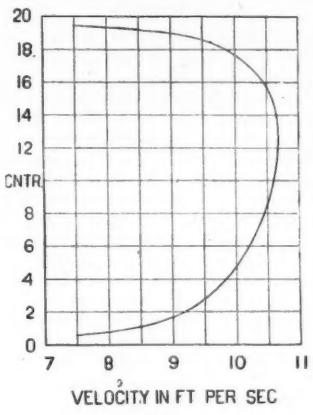


Fig. 10.

Besides this, even when the tube is inserted at 90 degrees from its original position, the point of maximum velocity still occupies the same relative position. Now it will be seen that the size of the tube will have a direct influence on the position of the mean velocity radius, which will not have the same position on both sides of the centre, unless the Pitot tube is very small indeed. This is where the tube shown in fig. 4 has the advantage, as only one pipe need enter the main; and this can be of such a size as to have practically no effect on the flow. In this case, it will not be necessary to make such a complete traverse of the main under test as would be the case if a larger tube were used. This is, of course, assuming a steady flow, free from serious eddy currents.

A series of tests were also made in the 20-inch gas-main when passing various mixtures of coal and carburetted water gas, in order to check the accuracy of the tube when applied to low-velocity flow. Table I. shows the method adopted.

TABLE I.

—	1.	2.	3.
Temperature of gas in main in degs. Fahr.	67	60	66
Pressure of gas in main in ins. of water .	9	10	10·2
Specific gravity of gas	·51	·55	·57
Weight per cubic foot at temperature and pressure in main, in pounds	·0391	·0431	·044
Mean velocity by meter in feet per second	5·94	7·40	8·30
,, ,, ,, Fitot ,, ,, ,, ,,	5 895	7·38	8·33
Value of K	1·007	1·003	·996

The weight per cubic foot of gas flowing in the main is calculated from its specific gravity and corrected to the temperature and pressure in the pipe at the Pitot tube position. The volume of the gas passed by the meter is also corrected to the above temperature and pressure in order to get the actual quantity passing the Pitot tube. The value of the factor K is a measure of the accuracy of the tube. It is possible to get within ± 2 per cent. of unity with these low velocities. In order to obtain this degree of accuracy, however, it is necessary to be extremely careful in ascertaining the mean velocity, and also the weight of the gas per cubic foot. At such low velocities as we are dealing with now, the slightest mistake in obtaining either of the above factors will soon bring the error of the tube up to 10 per cent.

PRACTICAL USES OF THE PITOT TUBE.

Before concluding, I should like to suggest a few practical uses to which the Pitot tube might be put. The distribution engineer would find it a most useful instrument. It would enable him to ascertain the loads on the various trunk mains during the different hours of the day—thus allowing him to judge their capability for supplying during times of peak load; also, when contemplating an extension of gas-mains to supply a new or growing district, it

would show whether the existing leading mains were capable of meeting this extension without enlargement. Indeed, in any case where the quantity of gas flowing in a pipe is required, the Pitot tube at once offers a means of obtaining this information; and I believe it is the only instrument that can be used on any sized main, for this purpose, without any alteration in the pipe line or previous calibration, and, above all, with so little trouble and expense.

Another application of the tube would be in the case of a fall of pressure in a main. Obviously, this may be caused by either excessive demand on the capacity of the main or decrease in its effective area caused by water or naphthalene. The pressure-gauge will not provide reliable information as to which of these causes the drop is due; but the Pitot tube would at once show it by indicating the quantity of gas actually flowing. I have already shown the use to which it was put on our water-gas plant; and I have in mind the application of the tube for the regulation of the length of the run and the amount of steam to be used in the generators, by its indication of the amount of gas made during different periods of the run. No doubt many other uses for the tube will suggest themselves to you, either in the works or on the district.

Discussion.

The PRESIDENT (Mr. D. J. Winslow, of Lea Bridge) remarked that Mr. Griggs had given them an excellent paper; and he trusted there would be a good discussion.

Mr. J. HEWETT (South Metropolitan Gas Company) said that the Pitot tube to his mind—he could not be said to have had a great deal of experience with it—though very well in principle and theory, was an instrument which Mr. Griggs, so far as he knew, was the first man to actually put into practice with reliable results. A few years ago, it was his (the speaker's) unlucky experience to be asked to estimate the amount of gas passing through a main; the only instrument that was available for the job being a Pitot tube. It was a very good instrument, he believed—one of the best; but he, being doubtful, took the precaution of trying it first with a meter at the other end. As far as he had been able to understand, he could not find anybody who had really tried the Pitot tube on a main where there was any other accurate method of measuring so as to check the results obtained; hence everyone got splendid results, and was satisfied. Where he had most frequently seen the tubes used was on the outlet of fans, where the velocity of the air or gas, or what not, was so rapid, or the amount of gas passed was so great, that it was not practicable to insert a meter, or for other reasons it was not done; and consequently people took the Pitot tube, and accepted the results as gospel. In his own case, however, he was not prepared to do so; and, as he had said, he tested the instrument, on a 16-inch gas-main. Unfortunately, he had not very much time at disposal; and, though he would have liked to have gone a great deal further into it, after two or three days messing about with it he gave the trial up in disgust. Several things militated against success. One was the station-meter at the other end of the main to check him; and another was that, though the people who were responsible for the instrument had supplied a liquid for the gauge which was of known specific gravity, they seemed to have neglected the fact that its viscosity prevented quick and accurate results, and when the liquid moved, it took a long time to get back to its original zero. So he put it on one side, and thought, "We shall have to go back to the old wet meter." In this way, they arrived at no real conclusion; but Mr. Griggs seemed to have solved the problem. He was very pleased he had carried out these experiments with a meter at the end of the main. This was everything. It was all very well to place a Pitot tube in a main, and put forward a sheet of results. The introduction of the micro-manometer gauge by the author appeared to have facilitated the measurement of the slight difference which the velocity head of the gas would make in respect of the static pressure. It was a very happy application of the principle that, having a large vessel and a small tube, the effect of pressure in the large vessel was that a very small difference in the level of the liquid in the larger vessel made a long column of liquid rise or fall in the smaller one. The fact that Mr. Griggs had been able to get results on a gas-main where the mean velocity by the meter in feet per second was 5·94, and the mean velocity by the Pitot tube was 5·895, spoke volumes. It reflected a great deal of credit on the operator; for he was sure that, to get these figures so close, Mr. Griggs must have gone thoroughly into the matter. He must have devoted a considerable amount of time and patience to it—perhaps patience was required as much as time in experiments of this kind. He was rather surprised to find that the mean velocity point was quite so near the circumference of the main. The thing that really militated against the use of the Pitot tube in general was the extreme care and great amount of time required. They must estimate the specific gravity of the gas, and they must also know the specific gravity of the liquid in the gauge. While he was on this point, he would like to ask Mr. Griggs why he used alcohol—seeing that he was able to measure with his micro-manometer arrangement such very small differences. The specific gravity of alcohol was ·8, as compared with 1 for water—that was, only 20 per cent. less. Did he think he could discard the use of alcohol, and employ water, and so eliminate the correcting factor in the equations? If so, it seemed to him it would be very useful. Having carried out the experiments, the author would be in a position to say whether the use of alcohol was "worth the candle."

Mr. W. T. BURTON (Leatherhead) said it seemed to him the Pitot tube could tell them, if they knew what a main should do, what it actually was doing; and, after all said and done, this was one of the most important factors to the distributing engineer. Did he understand Mr. Griggs to say that the mean velocity of the gas was near the circumference of the pipe? This was rather a surprise.

Mr. G. COX (South Metropolitan Gas Company), referring to the different tips the author used, asked whether it would be better to employ a round bend rather than a square elbow. Mr. Griggs's charts showing the velocity in feet per second bore out the usual formula that the velocity increases as one gets towards the centre of the pipe—thus showing the retardation due to skin-friction in the pipe.

Mr. W. NEWTON BOOTH (Woolwich Arsenal) said he wished to congratulate the author on his paper, and on the very excellent way in which he had presented the results of his many experiments. He was particularly interested in the diagram showing the variation of the gas velocity across the diameter of the pipe, as it practically coincided in form with similar diagrams taken from water-mains. One point he would have liked to see more clearly explained was the calculation of the mean velocity of the gas in the pipe from such a diagram. It must be remembered that the correct result could not be obtained by splitting up the diameter into a number of equal portions, and taking the mean of the velocities found for each of these portions, because the area of the annulus represented by such portions near the circumference was much greater than for portions nearer the centre. Again, regarding the values of the constant K in the formula $V = K\sqrt{2gH}$, it seemed to him that the values were expressed to a far greater degree of accuracy than was justified by the experiments. The greatest range 1·007 to ·996 only represented an error of $\pm$ 0·55 per cent.—an error it was very easy to make on such experiments. While fully realizing the usefulness of such a method of gas flow measurement, its limits must be borne in mind, and results could not be relied on to too great accuracy.

Mr. E. SCEARS (Hampton Court) said he was sure they were all thankful to Mr. Griggs for his carefully prepared paper. He (the speaker) had an opportunity some years ago of carrying out a lot of experiments with a Pitot tube, and constructed eventually a gauge very much like fig. 5 for registering the effect of two tubes in the main. The great difficulty that came across all operators with the Pitot tube was the extremely small amount of difference between dynamic and static pressures. Mr. Griggs, in the apparatus shown in fig. 5, overcame this. By exaggerating the readings, he made them more reliable, and so made the apparatus of more practical use. This was the line he (Mr. Scears) followed on, too; but in the actual tubes which were in the main Mr. Griggs, he saw, did not put them in the part of the main where he got the biggest difference shown. The bigger the difference that was actually shown on the gauge, the more reliable it would be; and he thought the tubes should be in the middle of the main, where there was the highest velocity. True, they had to use a correcting factor to get the mean velocity; but surely they got a bigger reading on the scale, and therefore made the apparatus of more practical value. Also the Pitot tube facing the flow might be enlarged, instead of being of the shape the author used. He would like to know Mr. Griggs's objection to using apparatus of this sort with the Pitot tube enlarged and in the centre of the main. Then, again, the glass tube was of such small diameter and inclined so that when one looked at it horizontally the meniscus was of considerable length. He thought the apparatus was read very much more easily by looking down on to it; when it would be found that the meniscus appeared as almost a straight line. One other point was the value of the constant K as shown in Table I. He took it this was not a constant entirely, but varied with the specific gravity of the gas.

Mr. GRIGGS: No, it does not vary with the specific gravity of the gas. It varies with the rate of flow.

Mr. W. L. WESTBROOK (North Middlesex Gas Company): I take it the four tips referred to are facing the flow of gas?

Mr. GRIGGS: No, at right angles to the flow, and used for recording the static pressure.

Mr. WESTBROOK said it struck him that, with the different formation of the tubes, there would be a great deal of difference in the effect of the flow of gas, if they had been used facing the flow. Another point he would like to allude to was in regard to the suggestion that the Pitot tube should be used in ascertaining the flow of gas in any main that was perhaps overloaded. Would not the results be influenced considerably by the actual draught going on in the main at the time of the test, and would not the Pitot tube be used in conjunction with a pressure-gauge to give the information required?

The PRESIDENT remarked that the subject dealt with in the paper was a very fascinating one; and the author had been fortunate in having an opportunity of making these experiments. The Pitot tube was very useful, as Mr. Griggs mentioned, for the distribution engineer, to find out the amount of gas passing through any particular main. Of course, there were some varying factors to be taken into account—specific gravity, temperature, and pressure. It occurred to him that perhaps Mr. Griggs could draw up a kind of table for these varying conditions, in the same way that they had tabulated charts for correcting volumes of gas. He did not know whether this would be too big a thing to undertake. Even station-meters varied at times. It would, of course, be very useful if they had a table with which they could get more or less direct readings of pressure or velocity as shown by the Pitot tube.

It appeared that the Pitot tube would be very useful to the gas man, even if he did not want to calculate the actual amount of gas passing through a main. In connection with stoppages in mains, they might use the tube in different places; and as they could measure to within 1-5oooth part of an inch they might be able to gauge where the stoppage had occurred. He had received the following communication from Mr. Clark, who was unable to be present at the meeting.

Mr. J. G. CLARK (Gaslight and Coke Company) said: "Having just perused Mr. Griggs's paper with some degree of pleasure, I should like to take this opportunity of congratulating him on having so successfully used the Pitot tube. The data provided ought to prove useful to others working in the same direction. It occurred to me, when comparing figs. 8 and 9, that, incidentally, they illustrated the probable inductive effect of wind on domestic chimneys—causing strong up-draught during high wind. Tips Nos. 1 and 3 resemble very closely the most common types of chimney pots; and fig. 9 shows that the inductive effect is considerable. From Mr. Griggs's data, one might think that a conical collar resembling tip No. 2 would, if fitted to a chimney, prevent a lot of the up-draught troubles due to high wind. The means to explore the distribution of gas in a network of mains ought to prove very valuable in these days of frequent extensions. As Mr. Griggs points out, the Pitot tube enables one to do this, and provides useful information for the guidance of the distributing engineer in carrying out extensions. Simple appliances are used by electrical engineers for ascertaining the load on their branch feeders, and are no doubt extremely useful to them in investigating the distribution of their output. I presume that there must be a reasonable proportion between the size of the tips and the size of the main."

Mr. GRIGGS, in the course of his reply to the discussion, said Mr. Hewett had queried the point of mean velocity in a main. This did not seem to him to be very important. Generally when testing a main, one took a complete traverse of the diameter. It was a matter on which the authorities did not seem to agree. Some placed it at 70 per cent. of the radius, and others at 75; while Bryan Donkin put it at 65. One would not rely upon the position of the mean velocity radius when taking a test. He himself always held that a complete traverse should be taken.

Mr. HEWETT pointed out that he was not arguing really against the position. He only mentioned that he was rather surprised to find it so near the circumference. He thought it was generally understood, roughly perhaps, to be at a point somewhere near one-third of the diameter. However, by taking a complete traverse of the main, Mr. Griggs did not guess at the mean velocity, but found it, and this made all the difference in his favour.

Mr. GRIGGS remarked that the position of the mean velocity radius, of course, depended upon the flow of gas. The reason he used alcohol was because it gave the gas a more definite meniscus. As to Mr. Cox's question about square elbows or round bends for the tips, this would make no difference, because there was no flow through the inside of this tube. Mr. Booth had alluded to the reliability of the constants, and he took it he was referring to the Venturi meter tested with air. At the Bromley Gas-Works, where Venturi meters were first used for gas measurement, most complete tests were taken in conjunction with Messrs. Kent; and they found the constant K was really a constant. He did not say that the constants given were absolutely accurate in themselves for all velocities.

Mr. BOOTH: It is useless to express your results to a greater degree of accuracy than your instruments will give.

Mr. GRIGGS (continuing) said Mr. Scears asked why he did not put the facing tube in the centre of the main, to get a better reading of the velocity head. The ratio of the mean velocity to the maximum was 0·8 to 1, so they would see that there was not much difference. When referring to the use of large Pitot tube tips, he supposed Mr. Scears meant trumpet-shaped ones. For comparative readings, this would be quite all right; but there was always a chance in increasing the Pitot tube tip of introducing an error which was liable to vary as the rate of flow was increased. They found a greater exaggeration with a high volocity than with a low. He had been asked, in connection with testing the draught on a main, whether it would be necessary to use a pressure-gauge in conjunction with the Pitot tube. The draught on the main was due to consumption, and the Pitot tube would show this at once. It would not matter when they used it. He did not know whether it would be found worth while to prepare such tables as the President had suggested. He had not applied the Pitot tube to finding stoppages in mains; but he thought it would be equally reliable in connection with such an operation. Mr. Clark said he presumed there must be a reasonable proportion between the size of the tips and the size of the main. The only factor governing the size of the tip in the main was the area of it; and he (Mr. Griggs) had remarked that the area of the tip of the Pitot tube itself must be relatively small as compared with the area of the pipe. He should say also that the size of the tip was governed by the velocity. If the expected velocity was at all high, they must use a large tip; but taking the tips shown in figs. 3 and 4, it did not matter what sized main they had.

Mr. WESTBROOK: Of course, I know the draught on the main depends on the consumption; but if you wanted to know whether the main was overloaded, and you had very few consumers using gas, you could not have the same velocity of flow as when all the consumers were on. Therefore, in using your tube, I take it you would have to do so in conjunction with a pressure-gauge,

Mr. GRIGGS: If there was practically no consumption on the main, there would be a small quantity of gas flowing and a smaller velocity.

Mr. WESTBROOK: Supposing there was an obstruction, or your main was not adequate to the demand on it, your tube would not show it unless you had the maximum demand on.

Mr. GRIGGS: It would be necessary to put the tube in one or two positions before and after the obstruction. The static limb of the tube is equivalent to an ordinary pressure-gauge.

Mr. S. A. CARPENTER (North Middlesex Gas Company), in proposing a hearty vote of thanks to Mr. Griggs, said the great source of error seemed to be in connection with the static pressure tube; and it struck him that if this tube finished just inside the main, it would do away to a large extent with the inductive effect of the gas flowing across the tip. Could they not also do away with the static tube, and get an equation which could be worked on the static *plus* the dynamic pressure, as with the ordinary pressure-gauge just mentioned? It seemed to him that Mr. Griggs was not altogether enthusiastic about his experiments. The sources of error were many, and they might get serious errors, unless very great care was taken in making the tests. It was necessary to be so exceedingly accurate that the results must always be looked upon with suspicion.

Mr. HEWETT seconded the vote, which was carried with applause.

Mr. GRIGGS, in thanking the members, said Mr. Carpenter must have misread the paper with regard to the accuracy of the tube. It was not meant by him to be used as a standard meter, but for comparative readings only. And for tests on mains like air-blast mains, where an error of 1 or 2 per cent. meant nothing, it was quite reliable.

DETERMINATION OF CYANOGEN COMPOUNDS IN GAS LIQUOR.

The following is an abstract translation of a paper on this subject, by Herr F. Weisser, published in a recent number of the "Chemiker Zeitung."

Great interest is attached in the gas industry, as also in coke-oven practice, to the cyanogen compounds which are set free during the dry distillation of coal; since it has been recognized that very considerable damage is caused to apparatus, especially ammonia and benzol stills, by the cyanide of ammonia contained in the gas which is treated. Owing to the ready solubility of the ammonium cyanide contained in the gas, it is only natural that a large proportion of that produced should be found in the liquor which comes from the ammonia washers. Therefore, special notice must be taken of the cyanogen which this liquor contains. For this reason, there is an increasing demand for reliable laboratory methods of testing qualitatively and quantitatively the cyanogen compounds contained in this liquor. Several good methods of testing ammoniacal liquor have been in existence for some time [those of Dyson, Pfeiffer, Lunge, and Linder are mentioned by the author]; but none of these pays sufficient attention to the cyanogen compounds.

The liquor contains cyanogen in the forms of ammonium cyanide, ammonium ferrocyanide, and ammonium sulphocyanide. As two contradictory views exist as to the presence of ammonium cyanide, and as very little has up to the present time been written on the subject, it may be as well first to record a few observations made with regard to it. Pfeiffer denies the presence of ammonium cyanide in the liquor at all; and this view is supported by Lunge in his method of analysis. Bertelsmann, on the other hand, claims to have proved its existence definitely. Extensive tests on the subject were carried out in the laboratories of the Witkowitzer Coal Mines with samples of liquors from coke-ovens of the Ostrau district; and it was found that all these samples contained the largest part by far of the cyanogen in the form of ammonium cyanide and ammonium sulphocyanide, with a comparatively small proportion in the form of ferrocyanide. The average proportions in the litre of liquor were:

Hydrocyanic acid (HCN)	0·125 gramme
Ferrocyanic acid ($H_4Fe(CN)_6$)	0·030 ,,
Sulphocyanic acid (HCNS)	0·225 ,,

The fact that the liquors tested by Pfeiffer contained no cyanide of ammonia can only be attributed to external circumstances. It is well known that the hot gas, as it leaves the oven, contains the cyanogen in the form of hydrocyanic acid or ammonium cyanide with, perhaps, traces of dicyanogen. The formation of the ammonium sulphocyanide follows later through the action of the ammonium sulphide formed and of oxygen. The ferrocyanide is formed by direct action of the ammonium cyanide on the iron of the apparatus. If the temperature of the water used for the washing is comparatively high, the ammonium cyanide absorbed by it cannot be retained, owing to its ready volatility (boiling point 96·8° Fahr.); and as far as it has not been changed into ferrocyanide or sulphocyanide, it is carried on again with the passing gas. Of course, in these circumstances, the liquor will contain no ammonium cyanide. It must further be taken into consideration that the ammonium cyanide will readily act on any iron that may be contained in the washing water; the conditions for such action being extremely favourable. Hence, if this water is comparatively

rich in iron, the whole of the hydrocyanic acid not taken up as sulphocyanide will possibly take the form of ferrocyanide. This is, however, not possible when the rotation method is employed, as the same water is always used again for washing. In the usual working conditions, however, a certain quantity of ammonium cyanide always remains in the liquor; for the temperature is kept low, and the ammonium cyanide does not remain long enough in contact with the apparatus to permit of much being converted into ferrocyanide. Moreover, the water used does not often contain much iron.

Determination of the Ammonium Cyanide.

Qualitative Test. 100 c.c. of the liquor are acidified with hydrochloric acid, mixed with 15 c.c. of 10 per cent. solution of ferric chloride and 5 c.c. of 10 per cent. solution of ferrous sulphate, and allowed to stand for several hours. The precipitate of prussian blue and sulphur is then separated by filtering, the filtrate rendered strongly alkaline by the addition of caustic potash, and then boiled. The precipitate which forms again is filtered off; the filtrate is acidified with hydrochloric acid; and 5 c.c. of solution of ferric chloride added. If the solution contained originally ammonium cyanide, prussian blue is now thrown down. As the blue coloration due to the prussian blue is obscured by the colour of the sulphocyanide of iron present, the liquid should be allowed to stand for from twelve to twenty-four hours, when the precipitate will be found to have separated out clearly.

Quantitative Test. This test depends on the difference between the total amount of cyanogen present and the amount of ammonium ferrocyanide. The total cyanogen is best found thus: To convert the ammonium cyanide into ferrocyanide, 500 c.c. of the liquor are shaken up in a litre flask with 50 c.c. of solution of caustic potash (1 part to 1 of water) and 50 c.c. of 10 per cent. solution of ferrous sulphate, and warmed for one to two hours on a steam-bath. The mixture is then cooled, made up to the mark, and filtered clear of the precipitate of hydroxide and sulphide of iron. Then 100 c.c. of the filtrate are strongly acidified with hydrochloric acid, and prussian blue is precipitated by adding 5 c.c. of 10 per cent. solution of ferric chloride. After standing for twelve to twenty-four hours, the blue is filtered off; slightly washed with cold water; and treated with dilute caustic potash. After boiling the solution, it is filtered clear of ferric hydroxide, and the filtrate, which contains the whole of the cyanogen as potassium ferrocyanide, is evaporated to dryness after the addition of an excess of sulphuric acid. The residue is lightly ignited, dissolved in sulphuric acid, and this solution is reduced in the usual way with zinc and titrated with centinormal solution of potassium permanganate. Then 1 c.c. of the latter used represents 0·00156 gramme of cyanide.

The amount of ammonium ferrocyanide present is determined by the method described below. Then, if in the test for the total cyanogen in one litre of liquor x c.c. centinormal permanganate solution were used, and y c.c. for the ferrocyanide test, the ammonium cyanide in one litre of liquor is 0·00264 $(x-y)$ gramme of NH_4CN.

Determination of Ammonium Ferrocyanide.

The author mentions several methods which have been used for this test—notably those of Dyson and Pfeiffer. He points out that none of these was really reliable; in some cases only a third, or even less, of the total ferrocyanide of ammonia being shown. A comparatively easy method, however, of arriving at a correct result is to determine the total quantity of iron in the liquor, as this can only exist in the form of ammonium ferrocyanide in the presence of ammonia and sulphuretted hydrogen. This test is carried out as follows.

A convenient quantity of clear, filtered liquor (100 to 500 c.c.) is evaporated to dryness in a porcelain dish. The residue is carefully heated to incandescence to destroy organic substances. The residue after ignition is dissolved in concentrated hydrochloric acid with a few drops of nitric acid added; and this solution, after the addition of 10 c.c. of sulphuric acid (1 of acid to 1 of water), is again evaporated nearly to dryness. The residue is dissolved in 20 c.c. of sulphuric acid of the same strength; and this solution is reduced in the usual way with zinc and titrated with centinormal solution of potassium permanganate. Each cubic centimetre of the latter used represents 0·00284 gramme of ammonium ferrocyanide. This method gives good uniform results.

Determination of Ammonium Sulphocyanide.

For this the author suggests a modification of Pfeiffer's colorimetric method. According to the latter, 10 c.c. of the liquor are first freed from sulphuretted hydrogen and treated with 10 c.c. of 6 per cent. solution of ferric chloride in 10 per cent. hydrochloric acid. The solution is then made up to 500 c.c., and the red coloration in 100 c.c. compared with that of a solution of pure ammonium sulphocyanide treated in the same way. But this method unmodified is impracticable, as the fact is overlooked that the intensity of the red coloration is influenced by the quantity of free hydrochloric acid present and by the ammonium salts. The ammonia in the liquor neutralizes some of the hydrochloric acid, and ammonium chloride is formed; so that the conditions are not the same as in the parallel experiment with the pure sulphocyanide. This difficulty can be surmounted either by boiling the liquor, whereby the amount of free ammonia present can be determined at the same time, or by steaming on a water-bath. The sulphocyanide in the liquor is not affected even by hours of boiling.

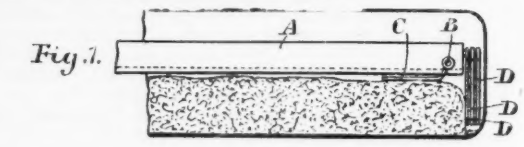
A very convenient way of carrying out the test is as follows: First 50 c.c. of the liquor are diluted with 50 c.c. of water, and reduced on a steam-bath to a volume of about 30 c.c. The solution, now freed from volatile ammonia, is washed into a 100 c.c. flask, which is then filled up to the mark. Of this solution 20 c.c. (corresponding to 10 c.c. of liquor) are treated with the acidified solution of ferric chloride, and Pfeiffer's method (already described) is followed. This preliminary treatment of the liquor also avoids the necessity of first driving off the sulphuretted hydrogen.

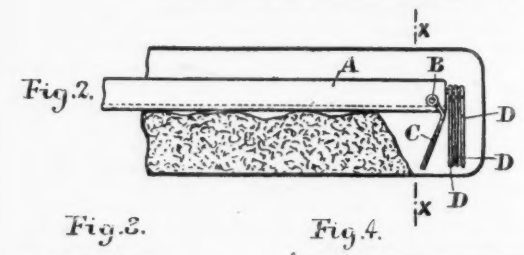
Owing to the great variety found in the composition of gas liquors, slight variations of these methods may be necessary to meet special cases; but in principle they will be found generally applicable.

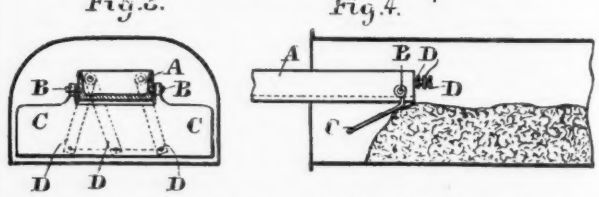
RAKE FOR DRAWING RETORTS.

In the "Journal" for the 2nd of January last, there was described and illustrated a rake for drawing retorts, for which a patent had been taken out for France by the Compagnie Anonyme Continentale pour la Fabrication des Compteurs à Gaz et Autres Appareils, of Paris. It has been found in practice that when the coke is not sufficiently compact, the arrangement allows it to be left in the retort by passing between the blades of the rake. This is obviated by an improvement for which the Company have taken out another patent.

In the accompanying illustrations, fig. 1 is a longitudinal section of the improved portion of the rake, which is shown at the end of the retort; fig. 2 is a similar section after the first operation of drawing; fig. 3, a transverse section of the retort on the line X of fig. 2; and fig. 4, a longitudinal section of the front portion of the retort, showing the rake being introduced.







The channel-iron A is furnished at the end with a loose flap C, hinged at B on to the iron, so that it can lie under it, but when free hang vertically in front of the blades D of the rake. This flap has much the same section as the bottom of the retort. When the rake is run in, the flap lies on the mass of coke, over which it slides, as shown in fig. 4. When the rake is in the retort, drawing is done in two operations. As stated in the original specification, the blades are worked to make them grip the coke, which is drawn out for the length of the flap—viz., for about 18 inches; and then the rake is pushed back to the end. During this process, the flap, being no longer supported by the coke, falls by its own weight behind the portion in the space left vacant by the blades, as shown in fig. 2. Then the whole is drawn out—the flap resting upon the blades of the rake so as to clear the retort.

Photometric Tests at the Reichsanstalt.—The report of the photometric work carried out in 1911 at the Physical-Technical Imperial Institute (Reichsanstalt) at Charlottenburg was published in a recent number of the "Zeitschrift fur Instrumenten-Runde." It states that, during the year, 95 Hefner lamps were certified, of which the majority had the optical flame-measurer. This makes a total of 1927 Hefner lamps certified since 1893, when the certification of them was instituted. There were also examined during the year for use as photometric standards 336 carbon-filament and 279 metallic-filament electric lamps. Durability tests were made on a number of electric lamps, and on twenty-four upright and two inverted incandescent gas-burners. Two self-regulating nipples, one for upright and one for inverted burners, which were examined, afforded a practically constant gas consumption with the gas pressure varying from 20·10ths to 38·10ths. Four incandescent oil lamps and two photometers were also examined in the course of the year.

SCOTTISH JUNIOR GAS ASSOCIATION.

WESTERN DISTRICT.

Inspection of Otto-Hilgenstock Coke-Ovens.

About eighty members of the Western District Division of the Scottish Junior Gas Association, accompanied by several representatives of the North British Association, visited Messrs. Nimmo's Auchengeich Colliery, Chryston, on Saturday; and they found there not only an interesting sphere of experiment, but also one of remarkable achievement in the use of the Otto-Hilgenstock coke-ovens plant, which, supplementing the colliery work proper, now forms a source of decided revenue. For the visitors, the experience was one of novelty, as there is no other possibility in Scotland of seeing an installation such as that at Carnack. It was, too, a curious experience, since the keenly interested gas makers found that what might be called the basic marketable side of their industry has been reversed, in so far as what they generally regard as bye-products have become the matter of essential production, and gas taking their place. Not the least noteworthy fact disclosed was that those in charge of the process believe that the gas so produced is capable of being applied to town lighting purposes; sufficiently convincing figures being provided in support of this belief. The general view of members of the Association, in so far as it was expressed, showed agreement with the idea that the Otto direct recovery process will play a large part in the never-ceasing development of gas-works.

The visitors were conducted over the plant by the Manager, Mr. George T. Purves, who puts as much enthusiasm as energy into the work. He explained the details of the process—showing the most comprehensive grasp of its principles and the remotest possibilities of its application.

All the coal used is washed free from clay and other foreign matter; the gum, dross, and part of the singles being used for carbonizing purposes. The dross, while still containing from 8 to 12 per cent. of water, is taken to the dross-handling plant at the ovens. Here the end-tip waggons are tipped by hydraulic rams; two waggons being emptied at once into the dross-pit, which has a capacity of about 30 tons. The dross is then elevated by a bucket-chain elevator and delivered into a shoot, which conveys it into two Jeffrey crushers. The dross is here crushed to a fine meal by heavy beaters which drive the dross against a cast-iron grid bottom at a high velocity. The finely crushed dross which falls into the receiving-pit is then elevated to a 300-ton storage bunker. The dross-handling plant is electrically driven.

The thirty coke-ovens, measuring 33 ft. 7 in. by 7 ft. 3 in. by about 1 ft. 9 in. in the middle, are built on the Otto-Hilgenstock system, with their patent top-heating arrangement, but without regenerator. The ovens are designed so as to be suitable for both top charging and compressed coke charging; one being the regular system of working, and the other only being employed in emergency. In order to carry out the system of top-charging, the steel bogies which run on three-rail tracks over the ovens are filled from overhead shoots in the storage bunker, and their contents are discharged from bottom doors into the oven in the usual way. The charge is then levelled by hand clots working through ports in the oven doors.

The Buchanan charging and discharging machine, which is electrically driven, runs on a four-rail track. The charging "peel" is filled from side shoots in the storage bunker, and the successive layers of crushed dross which are run in are compressed to a firm cake by a two-legged stamper. The complete cake of dross weighs a little more than 8 tons. The machine carrying the charge is driven up to the oven, and the completely carbonized charge is then pushed out—this operation taking from 2 to 5½ minutes. The peel is brought in front of the oven, and the compressed cake of dross carried into it on the peel. The door is then lowered, and the peel rapidly withdrawn. The charging operation takes about a minute.

The coke which is pushed out of the oven is in the form of a solid cake. It is passed through a cage quencher, where it is quenched by water in fine streams under considerable pressure; the water penetrating into the mass of coke. It then slides down the bench on to the coke-loading platform. The carbonizing plant will deal with 180 tons of dross per 24 hours.

The products of distillation are carried by the ascension-pipes into the hydraulic main without dip-pipes. They then pass through the collectors and the cooling-main, when they are partially cooled by a counter-current stream of ammoniacal liquor or of tar. After the tars and the ammonia have been removed, the gases, still saturated with water vapour, together with the benzene and lighter oils, at a temperature slightly below 70° C., are brought back and used for heating the ovens. The heating of the ovens is effected by 15 bunsen burners per oven wall. The products of combustion pass through vertical flues into a horizontal chamber near the top of the oven. The burnt gas is then collected in a main flue, and led through boilers for steam-raising for colliery purposes.

The crude gas passes from the collecting-main into the tar-extracting plant at a temperature of from 80° to 100° C. The gas is here freed from tar fog by the frictional action of ammoniacal liquor, which is forced by electrically-driven centrifugal pumps through the special spraying plant at a pressure up to about 70 lbs. per square inch. The gas then goes through a baffling chamber; finally leaving this portion of the plant at a temperature of from 68° to 75° C. The gas afterwards enters the exhausters, by which it is forced through the saturators. The exhausters are of the Rateau fan type, and are driven (through gearing) by De Laval steam-turbines of 110 H.P., rotating at a speed of about 2000 revolutions per minute. The saturators are of large size, and are completely closed; the sulphate of ammonia being ejected by means of air or steam. The acid is kept in agitation by centrifugal pumps. The sulphate of ammonia is collected on a table, from which it is discharged into a centrifugal drier. After passing through the saturators, the gas is returned to the ovens for heating purposes, as already mentioned. The entire bye-product plant is in duplicate; each set being capable of handling the products from 360 tons of coal per 24 hours.

A Comparison of Coke-Oven and Vertical-Retort Gas.

After the inspection, the visitors were entertained at tea in the miners' hall in connection with the works—Mr. Purves presiding. In a short address on the plant over which he had conducted the visitors, he expressed regret at the absence of Mr. John Gillespie, who when the plant was put down two years ago was Consulting Engineer for Messrs. Nimmo. As it was the pioneer plant in Scotland, many difficulties had to be contended with. These were very great indeed; but, as the members could see, they had been overcome. He wished to pay a tribute to the work of Mr. Gillespie. His hearers would be interested in knowing that what had been done at Messrs. Nimmo's was applicable to gas-works generally. He explained the very low capital cost, but pointed out that it was impossible—and the visitors would all clearly understand why—to consent to the publication of the particulars. But, giving figures, he showed that the working results per ton of coal were higher than those generally obtained in gas-works. Referring to the remarks made by Mr. J. Ferguson Bell, in criticism of Dr. Davidson's paper at the recent meeting of the Midland Association [*ante*, p. 433], Mr. Purves gave the following comparative table on the composition of gas:—

	Dessau. Dr. Davidson.		Glover-West. Dr. Colman.		Otto Ovens. Mr. Purves.
CO_2	2·4	..	3·2	..	3·0
$C_n H_{2n+2}$	2·8	..	2·3	..	2·7
O_2	0·5	..	—	..	0·9
CO	10·3	..	11·9	..	7·0
CH_4	28·0	..	28·0	..	28·8
H_2	51·0	..	53·5	..	49·8
N_2	5·0	..	1·5	..	7·8
	100·0		100·0		100·0

He pointed out that there was a close agreement in the composition of the gas made by him with that made in the Dessau retort. His aim, however, was not to produce such a composition of gas. The methane was practically the same, as also were the hydrocarbons. He must emphasize this fact, however, that the best results (in return per £1 of invested capital) were not obtained when the composition of the gas was as given above. With regard to the travel of the gas, Mr. Purves referred to the criticism as to its passing through the coal or along the retort walls in general practice. The cake of coal put into the Otto ovens did not, he said, touch the sides, and so left a free space for the gas to travel in. After carbonization, this space still existed. Charges drawn before complete carbonization showed the dross in the heart of the charge so little altered that the gas could not have travelled that way, and therefore it must have taken a course along the side of the retort. In view of this, and of the similarity between the composition of the gas from Otto ovens and that produced in Dessau vertical retorts, there was the suggestion that the latter gas took the same course. He did not think the composition of the gas would permit of the belief that it went through the core. He might state that the volume of coal in the oven occupied 96 per cent. of the cross sectional area. He again made the point clear that the gas produced was quite suitable for town supply. He felt that before many years had passed a great deal would be done in this direction. In his opinion, the problem of coal distillation was one of intensity of temperature and duration of heating, rather than of shape and angle of retort.

Thanks to Messrs. Nimmo and Mr. Purves.

Mr. David Fulton, the Hon. Secretary of the Association, voiced the thanks of the members to Messrs. Nimmo for the great privilege accorded to them of inspecting the plant. He said it struck him as interesting that Mr. Purves should consider that the gas they made would be quite suitable for town supply; but he wondered if it were really of the constant quality necessary for the purpose. He would like to know if the passing of the gas through the saturator had any effect on its illuminating value, and if it destroyed the light-giving hydrocarbons. He was sure the members must have particularly noted the quality of the coke produced. It was very dense and large, and of a beautiful silvery appearance; and, in spite of all prejudice to the contrary, it must be as good for all purposes as beehive oven coke.

Mr. J. W. Napier (Alloa), in thanking Mr. Purves, said that hitherto it had been their belief that recovery works produced results only known to those immediately concerned. But Mr. Purves had given the visitors information of a kind that would enable them to have a somewhat opposite conception regarding gas manufacture. The position that Mr. Purves now occupied at the

works was complimentary to the gas profession and to the Junior Association.

Mr. PURVES, in reply, admitted that the composition of the gas was very far from constant—it varying within very wide limits. With them a constant composition was not aimed at. But if the aim was to get it constant, it could very easily be attained. He felt quite satisfied, from the actual chemical point of view, that there could be no deterioration in illuminating power in the passage of the gas through the saturator, as neither the benzene nor the ethylene hydrocarbons were attacked by sulphuric acid of the strength existing in the saturator—viz., about 60° Twaddel.

SCOTTISH JUNIOR GAS ASSOCIATION.

EASTERN SECTION.

The Quarterly Meeting (the first of the new session) of the Scottish Junior Gas Association (Eastern Section) was held in the Masonic Hall, Kirkcaldy, on Saturday afternoon.

The chair was occupied by Mr. A. BISHOP, of Newtongrange, the Hon. President; and in opening the proceedings, he remarked upon the large attendance of members—thus indicating a keener interest in the affairs of the Association.

Mr. R. SCOTT (Cowdenbeath) read the following paper on

DAMAGE DONE TO MAINS THROUGH SUBSIDENCES.

If the following description of some of our experiences at Cowdenbeath through mining subsidences do not prove educative, they may at least prove interesting. I have been in charge of the distribution department now for some time; and in a locality such as ours, it is no sinecure. Not that the district is possibly any worse than other mining localities; but this may be said, our district is a very active one—thousands of tons of coal being brought to the surface daily.

The total depth of coal in the various seams worked averages from 40 to 50 feet. A question that we are often faced with is, Why can't gas be supplied much cheaper when you are so near the coalfield? The advantage of being near the coalfield is a small one—only the difference in cost of conveying the coal from the pit to the gas-works, the coal being the same price at the pit-head to everybody; while the disadvantages are many and varied. Another feature that interferes greatly with our distributing plant is the nature of the surface material. This consists chiefly of peat and moss, large areas lying in and around the town, divided here and there by banks of boulder clay, sandstone, or whinrock. The moss in parts runs to great depth, which makes building impossible at these places. Naturally the town is a scattered one, causing long lines of pipe to be laid over very dangerous ground.

The vibration and sagging of pipes in this mossy subsoil is a great enough evil, but nothing compared to the damage caused by mining subsidences. One of our worst districts is towards the south of the town, where we have a steel main running out about 900 yards to supply a small village. To avoid the high way-leave charge imposed by the District Council, the pipe was laid behind the boundary fence in the moss. Originally it was about 18 inches deep; but it has been lifted up and levelled so often that it is now almost on the surface, and gives least trouble there. Latterly, we have placed logs of wood under the pipe to help to prevent sagging.

The district is certainly a lively one, and is only a few hundred yards from where the terrible Donibristle disaster happened, when the moss broke into the mine, practically filling it up and causing a few deaths. The householders in the village are kept constantly on the move—shifting from one house to another, looking for the safest one.

In this locality we have had some amusing, if expensive, experiences. I remember a message coming in to say that the gas supply had failed; and we set out to find the trouble. At the foot of the hill which rises towards the village, we examined the water-trap, and on unscrewing the cap the water rose to a height of a few feet, and kept running till we got tired of waiting. We followed the main well up the hill, and discovered the damaged place. A water-main runs alongside the gas-main; and it so happened that, through a subsidence, both pipes had joints drawn at the same place, with the result that the water was leaving the water-pipe and running back down hill in the gas-pipe. It was evident that the water-pipe had been leaking for a considerable time, as the surrounding grass had a very green and fresh appearance—this being our first clue towards locating the trouble. A short time later, we had a very urgent message to send men at once. On arrival, it was found that a part of the roadway had suddenly dropped down some 10 to 12 feet, taking with it our cast iron main, leaving the broken end blowing full bore. The broken pipe was eventually plugged up; but it was a different matter getting workmen to enter the hole to carry out the repairs. However, after it had been filled and settled for a day or two, this was accomplished. A few days later, a horse yoked to a baker's van came a cropper at the same place. The main roadway suddenly collapsed, and the struggling horse went down. The driver cut the harness, and thus allowed the horse to go—to save himself and the van.

The houses are propped up and tied together in every possible way; but nothing can withstand the wreck and ruin of mining subsidences. Imagine our surprise, on getting notice to clear a meter and stove from one of the houses, to find the stove hanging down through a hole in the floor, also making tracks for the mine. Next door we were called in to save our meter, and found the only entrance was by the window, the floor behind the kitchen door having disappeared. In another district towards the west, we have just passed through an anxious time; but we are hoping to get relief through the replacing of 600 yards of cast-iron pipe with steel. This main runs right through to the village of Crossgates; and being a single line of pipe, without circuit, we are at the mercy of the mining subsidences for cutting off the supply. And what can prevent it? A "sit," as the miners call it, takes place, the main breaks, and in a very short space of time fills up with water, either from the surface or possibly from the water-main which generally shares the same fate as our own. Long lengths of the main get sagged, and water-traps have to be put in where originally none were needed. Split faucets, drawn joints, broken pipes, service-pipes twisted and drawn from the main pipe, are all every-day occurrences.

To give an idea of the district, I might mention that a new sewer laid a few years ago with its fall to the eastward is now running towards the west, where an outfall had to be made to clear it. The recently laid tram-rails were buckled up at this point like a piece of wire, and on cutting out the bad piece the two ends came together about 9 inches. The houses are getting wrecked, ceilings are collapsing and hurting the inmates in their fall. Back kitchens and stairways are falling away from the main buildings, and the tenants can easily watch each other's movements through the large rents in the partitions. I was in a house the other day where the tenants could easily shake hands through the wall and wish each other "Good morning."

It is a very difficult matter locating leakage in a mining district; the escaping gas making its presence felt at the most unexpected places. It follows the cracks and crevices of the disturbed ground and finds its way into broken sewers, escaping at the manholes. In some cases it travels long distances before coming to the surface. I have known the faulty part being discovered over 100 yards away from where the smell of gas was noticed. Among the smaller sizes of mains we often find the pipe broken right through; and for this we use the split collar, which lends itself to a speedy repair without cutting off the gas supply. Split faucets and badly drawn joints generally require to be cut out and new pipe inserted. Cast-iron mains laid a few years ago are now a patchwork of split collars and thimbles. Much trouble is also experienced with the service-pipes, although we use the best quality steam tube. We often find them broken away at teepieces, bends, and at other connections. We never lay service-pipes under houses in these districts, but prefer to keep them outside the building up to the point where the meter is fixed—thus minimizing the risk of gas poisoning through leakage. We are constantly on the watch for bursts, and require to be always ready at short notice day or night. I could relate many more experiences; but I am afraid they would only weary you. Yet I am sure you will agree with me that the disadvantages to be met with in a mining district are very much greater than any advantage that may be put forward.

Naturally, we pin our faith to steel mains; and these with the long sleeve or the rigid joint. Sometimes we use lead wool and molten lead for making the joints. We are also very particular about the qualities of the man who does the work. At the present time, it is proposed to lay the pipes on blocks of wood placed crossways in the bottom of the track to see whether they will help to prevent the pipes from sagging. For taking off connections from the steel main, we have been using the Parkinson expanding nipple; and it stands the heavy strains exceedingly well.

There are six or seven good seams of coals being tapped at present; the thickest one being about 14 feet, the others averaging from 3 ft. to 4 ft. 6 in.; and as each seam is worked new interruptions come along. There is a saying, "You will get used to anything;" and I think there is something in it, as we look upon our many troubles as part of our day's work.

The PRESIDENT remarked upon the highly interesting nature of Mr. Scott's paper, which showed that it was not a very pleasant job to be at Cowdenbeath looking after the mains.

Mr. GEDDES (Granton) thought that the discussion on both papers might be taken when Mr. M'Millan's paper had been read; and this course was agreed to.

Mr. J. M'MILLAN (Lasswade) then read his contribution on

UPS AND DOWNS OF A MANAGER IN A SMALL GAS-WORKS.

The ups and downs I have had to contend with for the past 25 years may be interesting to some of the gas managers here to-day, and I hope will prove useful to those who intend becoming gas managers. In December, 1903, I was appointed Manager of the Lochgilphead Gaslight Company. I found the works were situated in the centre of the town, thereby involving a great deal of extra expense. By the time the coal left the Glasgow Docks, and was stored in the shed at the works, the average price was 17s. per ton. Owing to the heavy freight on the luggage steamer, the tar and ammoniacal liquor yielded no return; but a ready market was always found for coke at 12s. per ton. Notwithstanding all these drawbacks, the price of gas to consumers was 5s. 10d. per 1000 cubic feet. The service-pipes were laid to the meter by the Company, irrespective of the distance; a rent of 3s.

per annum being charged for the meter. The principal consumers were the Argyll and Bute Asylum, a large distillery, and the Crinan Canal Commissioners at Ardrishaig. For the latter, the supply-pipe had to cross the canal. Owing to a dip on entering and a rise on leaving the canal, a drip-box was put on in the middle, with the suction pipe taken to the side for pumping purposes. A small gasholder was filled by this pipe, thereby keeping a steady pressure for the lighthouse and the canal bank.

One of my earliest difficulties was with the hydraulic main. After having it cleared of the pitch, resealing it, and getting the retorts working again, the following morning I found the station-meter coming back instead of going forward. I at once had the retort-lids loosened and the inlet to the holder shut. Investigating the cause of the trouble, it was found that the dip-pipes were made of lead, and had got turned up at the ends with the bars while removing the pitch. I had them removed, put on a round stick, and beaten out to their right shape. From the time they were replaced till the day I left Lochgilphead, they gave no further trouble,

Another little difficulty was with the single-lift gasholder, which was blown off the guides, and stuck on the way down. This happened during a fierce gale on a Saturday night, between the hours of 7 and 8. Another holder was turned on at once, thus putting things right for the night. The following morning, with the aid of some extra men, and the use of a few strong batons and a block and tackle (which are very handy about a gas-works), the holder was gently let down, and after a good deal of work and worry was put on the guides again. After getting the holder filled to blowing point, it was discovered that two of the bottom wheels were so much worn that they had got into a joint in the masonry of the tank, thereby causing all the trouble. These were taken out and replaced by broad ones; and care was taken not to fill the holder too full on a windy day.

My ill-luck did not desert me even then, for it was shortly after this that a burn at the back of the retort-house overflowed, and put out the fires. It rose to the extent of 4 inches in the flues. Very little can be said of this—only that it caused a lot of extra work. After getting all the water taken out by means of pails, and the fires set going, I used all the very best of gas producing coal to tide me over the difficulty. I may mention that the Secretary had all the ordering of the coal and material for the works when I was appointed; but after I was there eighteen months, a free hand was given me. This is a privilege, I think, which should be given to every manager. He is the party who is held responsible; and he should know the correct article which is required for his work.

When coming to Lasswade, I expected to find things in a more advanced form than usually experienced in the Western Highlands. I was very much surprised to learn that the Gas Company only supplied slot-meters, and that very sparingly; the proprietors supplying and fixing the ordinary meters, and also supplying and laying the service-pipes from the main. The only part the Company play in this important matter is in making the connection at the main. In my estimation, this is not a wise policy for any gas company. The gas is made to be sold, and companies should offer their very best terms to parties who desire to make use of it. In trying to get my Company to take over the meters and services, I submitted the following scheme for their consideration.

When an application is made for a supply of gas, the Company will provide the service-pipe at their own expense; but the cost of further extensions will be paid for by the applicant.

All upright pipes to be made of malleable iron, and their size regulated by the extent of the premises and the number of burners to be supplied.

For tenements of one storey, the pipe to be not less than $\frac{3}{4}$ inch bore, For one tenant branching into meter, not less than $\frac{1}{2}$ inch; and for two tenants, not less than $\frac{3}{4}$ inch. For tenements of two storeys, the pipe to be not less than 1 inch for the first flat, and $\frac{3}{4}$ inch for the second. If for two tenants, the pipes to be $\frac{1}{2}$ inch and $\frac{3}{4}$ inch respectively. For tenements of three storeys, the pipes to be not less than $1\frac{1}{4}$ inch for the first flat, 1 inch for the second flat, and $\frac{3}{4}$ inch for the third flat. If for one tenant, the branch to the meter to be not less than $\frac{1}{2}$ inch; if for two, not less than $\frac{3}{4}$ and $\frac{1}{2}$ inch respectively. For tenements of four storeys, the pipe to be not less than $1\frac{1}{2}$ inch for the first flat, 1 inch for the second, $\frac{3}{4}$ inch for the third, and $\frac{1}{2}$ inch for the fourth. If for one tenant, the branch to the meter to be not less than $\frac{1}{2}$ inch; if for two tenants, $\frac{3}{4}$ and $\frac{1}{2}$ inch respectively.

All pipes for services to be of malleable iron, and carried to within 18 inches of the meter, with a suitable brass coupling at the end for connection to the meter. All pipes outside to be tested to the satisfaction of the gas manager, before being covered or enclosed in any way. Meters to be fixed in such positions as the gas manager may approve of; but no meter to be placed at a greater height than 4 feet measured from the surface of the floor to the seat on which the meter is to be placed. Meters to be so situated as to leave a space of not less than 24 inches above the seat, to admit of perfect freedom for watering or other purposes. Meters fitted up, or connected to present fittings, to be placed with the dial to the front.

I am sure that, if this scheme were adopted, a big extension would be required in the retort-house, complaints regarding poor gas would be fewer, and satisfaction would be the result in every way.

With the introduction of gas-cookers in Bonyrigg and Lasswade, the complaints of poor pressure are on the increase. Knowing too well that the service-pipes to the meters are too small in many instances for a supply for both cooking and lighting, the Company will have to do something in this respect, if the sale of gas is to increase.

I would like to refer to one or two little difficulties which I have had to contend with at Lasswade. Three weeks after taking up my duties there, a 3-inch water-main, passing near the retort-house, burst, and the water found its way into the ash-pits. A lively time was experienced in keeping the pits dry. On discovering the source of the water, I had a small well sunk in the coal-shed. Here it was trapped and kept pumped until the main was repaired.

Another difficulty was experienced with a small telescoped holder, which went wrong during the severe frost in 1909. The outer and inner lifts got frozen together, thereby causing both to ascend at one time. When the outer lift was two sheets up, the inner lift freed itself, and left the outer lift hanging to the tank. The gas in the inner lift was let into another holder, and the outer lift was left hanging until the days grew longer. I then adopted the same plan as at Lochgilphead to lower the holder into its place.

The condensers at Lasswade are on the inclined system, and these next gave me trouble. I happened to go into the retort-house, and was surprised to find the back-pressure at danger point. On investigating the cause, I found that the condensation on the last pipe of the condensers was not flowing into the box, owing to the accumulation of crystals. All the retorts were in use, and the work could not well be suspended; so a 1-inch hole was bored in the pipe, thus relieving the pressure. These condensers receive a cleaning before the winter sets in, and another in the spring. As there is no steam available, this is all done by hand.

I believe in high heats, so last winter the ascension-pipes gave me a lot of trouble by choking at the mouthpieces. Since discarding the auger-pipe rimer, I have used one of the mushroom type, and thus got over this little difficulty.

I earnestly believe in educating my workmen in the general routine of the works. One feels at home when he has a staff that can be depended on at all times. Get them to understand that the manager is expected to secure satisfactory results for his company or corporation, as the case may be, and that they are expected to assist him in his efforts, and then the results will be of a much higher standard. The position of manager in a small works is anything but a sinecure, as he will find plenty to occupy his hands and brain, if his heart is in his work.

Discussion.

Mr. M'MILLAN asked Mr. Scott if he found lead wool an improvement on the other lead for joints.

Mr. GEDDES inquired what was the percentage of unaccounted-for gas at Cowdenbeath.

Mr. LAW (Montrose) expressed himself surprised at such a condition of matters being reported from Cowdenbeath, where he thought the gas would be cheaper than it was. He asked what was done in the case of a broken main where a lot of consumers were involved, and how the difficulty was overcome.

Mr. J. KINCAID (Kirkcaldy) expressed the pleasure he felt at listening to two most interesting papers. A paper such as Mr. Scott's was very appropriate to the Association. In the district, they had mains over coal-fields, and he emphasized that a solid foundation for gas-works was a primary consideration. In a place circumstanced like Cowdenbeath, the percentage of leakage must be a very serious item at the end of the year. At Kirkcaldy there was not much trouble over subsidences, which were, however, always going on. They kept a staff of workmen doing nothing but look after gas escapes; and they found that after being at this work for some time, they became experts. What was required for work of this kind was patience and perseverance; and their employees possessed these qualities. Within the last year, they had laid down a quantity of steel mains, and were waiting to see what the effect would be. They had used steel mains with rigid joints, and with lead wool; but there was not much difference. A great deal depended upon how the lead wool was handled; and given a good heavy hammer, it was more a matter of strength than of brains. In steel mains there was some difficulty about getting the diameter of the pipes uniform; and he thought that the makers ought to give them a better joint. In regard to Mr. M'Millan, they all appreciated the hard work he had done. They knew Lasswade was a bit behind the times; but now that Mr. M'Millan was in charge, they would no doubt see it coming to the front.

The PRESIDENT asked as to the size of the wood blocks that were placed underneath the pipes to prevent them sagging.

Mr. SCOTT, in reply, said that, regarding lead wool and ordinary lead, he agreed with Mr. Kincaid that there really was not much difference. If they got a man with a heavy hammer, and who knew how to work it, he could make a joint as good as any other kind. The leakage at Cowdenbeath was 14 per cent. per annum. They got out of their difficulties very well, however. Where there was a big district supplied, and where an extra big break occurred, they had a bye-pass to get the leakage remedied. The pieces of wood put in to prevent sagging, were about 6 feet long; 3 feet of the length being in the bank, and 3 feet out. In the new main that was being laid down, the blocks were 15 inches in length and 4 in. by 4 in.; and they found these stood the pipe very well.

Mr. GEDDES asked Mr. M'Millan if his Directors had any reason other than capital considerations for not supplying ordinary meters to the consumers.

Mr. M'MILLAN said this was the only reason for not doing so, so far as he understood.

Mr. LOW remarked that a small gas-works could be worked as smoothly as a big undertaking; and he instanced the case of one

of those at Edzell. Here the make was from 500,000 to 700,000 cubic feet per annum, and the man in charge was single-handed. There were never any complaints; and he did all the work himself. The works had been in operation about twenty years, and he never had had anything serious to contend with.

Mr. M'MILLAN: He is lucky.

Mr. LOW (continuing) said he might be lucky, but this did not alter the fact that a small gas-works could be worked as easily as a big one. He admitted that the smooth working of small works might be largely due to circumstances.

Mr. GEDDES, in bringing the discussion to a close, remarked upon the instructive nature of the papers. They told of things seen, and of what had been experienced at first hand. The management of a small gas-works was a valuable experience, and led to the cultivation of initiative and ingenuity.

A hearty vote of thanks was accorded to the authors for their contributions.

GAS DEVELOPMENT IN KIRKCALDY.

At the conclusion of the business proceedings, Mr. Jas. Kincaid, the Manager of the Kirkcaldy Gas-Works, entertained the company at tea in the Crown Hotel.

Mr. KINCAID presided; and he was supported by Bailie Wright, the Convener of the Gas Committee of the Town Council.

The CHAIRMAN expressed his pleasure at seeing so large a turn-out of the members of the Association; and he bade them welcome to Kirkcaldy. In this district, as in other districts, they felt that they must be very much alive to their own interests. The competition from the electric light was being felt there as elsewhere; and although the Gas Department was not a very old one, at the same time they were having a fair field and no favour. That being so, he could look forward with confidence to the future of the gas undertaking in Kirkcaldy. They had at the present time a scheme which, if carried out, would make them in a position to meet all the demands of the district for many years to come. He had left the meeting of the Association before the discussion had become general; but the discussion, after all, was not of so much value as the papers themselves. The mere fact of the Association receiving these papers served a very good purpose. For instance, he had had the great pleasure, within the last few days, of perusing a paper on "Purification" read before the Yorkshire Junior Association. He wished their own Junior Association all success, and remarked upon the educative value of the visits which the members paid to the different works and centres.

Bailie WRIGHT remarked at the outset upon the energy and industry of those engaged in the gas profession. He had had the privilege of attending two conferences of gas engineers, and was very much struck by the interest and enthusiasm which was evinced, and he was glad to see that the juniors were emulating the seniors in this respect. He urged the necessity for the further development of the gas industry, and recalled how a few years ago it had been threatened to have its capacities curtailed. There was room for the development of the industry along scientific lines, if only so as to make it the more readily adaptable and available for rapid and economical lighting. They must aim at supplying gas as cheaply as possible; and here he recounted the experiences of Kirkcaldy. They had only recently taken over the gas-works from the old Company. The public, under the old *régime*, were content to pay a high price, and take gas of any quality the Company gave them. The moment the Corporation took over the gas-works, the public at once demanded free cookers, free meters, and, indeed, there were some of them that would not object to having free gas. Mr. Kincaid could not, however, make gas for nothing. They paid a high price for the undertaking; but he felt they got it at a very reasonable figure, although he knew some of his colleagues thought differently. The building and the machinery might be old; but still, it was there, and was making a good revenue for the Company, and they had to pay the market value for the concern. If the Town Council allowed them to go on with the new scheme Mr. Kincaid had brought forward, he had no doubt they would be able to bring the price of the gas down to be more uniform with that charged in other towns.

Mr. GEDDES, in replying for the Association, remarked that it was the duty of the Junior Associations to educate the consumers in the proper methods of using gas, as well as seeking to acquire experience and knowledge so as to benefit themselves professionally. He looked forward in great hope to the future of the Junior Associations. They had done good work in the past, and they would do a still better work in the future. They in the Eastern District had been twitted at times by way of comparison with other Junior Associations that might be mentioned. Those who made such comparisons should, however, remember the geographical position in which they were situated, as they went as far south as Keiso and as far north as Aberdeen. In conclusion, he wished Bailie Wright all prosperity in his connection with the gas industry in Kirkcaldy.

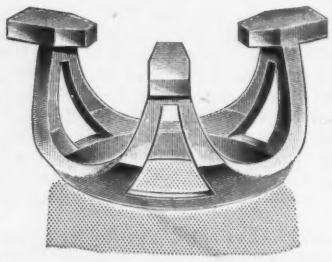
A hearty vote of thanks was accorded to Mr. Kincaid for his hospitality and kindness, and the proceedings were brought to a close by the company joining in singing "Auld Lang Syne."

Mr. John Eliot Hodgkin, the Managing-Director of the Pulsometer Engineering Company, Limited, whose death on the 5th ult. was noticed in the "JOURNAL" shortly after its occurrence, left estate of the gross value of £30,115, of which £26,373 is net personalty.

At the opening meeting for the session of the Royal Society of Arts on Wednesday, a medal was awarded to Mr. H. A. Roberts, M.A., for his paper on "Education in Science as a Preparation for Industrial Work," which was noticed in the "JOURNAL" for the 5th of March last.

NEW MANTLE RING.

There has just been put upon the market by Messrs. Ernst Hildebrandt, Limited, of Earlsfield, S.W., a new mantle ring for Graetzin and similar types of incandescent burners. This ingenious form is said to contain a good many important advantages over the ordinary type of ring, as used with these burners. It is well known that with all gas-burners of the intensified type—particularly the high-power low-pressure lamps now getting so popular—that glass cylinders are used; but the form of the rings at present employed reflects the heat and products of combustion on to the inside of the cylinders, and thus causes discoloration and often the melting of the cylinders. The new "skeleton" ring is designed to overcome these disadvantages, as the products of combustion escape much more quickly, and consequently draw in more fresh air to the point of combustion. Another important thing from the mantle manufacturer's point of view is that the ring contains much less material; and there is, therefore, less risk of the rings cracking in the process of seasoning the mantles. It has, we understand, been arranged that mantles on the new "skeleton" rings may be obtained from all manufacturers of these goods.



A Timely Notice.

A correspondent forwards a circular letter his firm have received from the Keighley Corporation, dealing with a matter that has more than once had notice in the editorial columns of the "JOURNAL." It is signed by the Town Clerk, Mr. W. Bagshaw.

At a meeting of the Town Council held on the 24th of August, 1909, the following resolution was carried, namely:—

> "That all officers and employees of the Corporation be strictly forbidden to accept any gift of any description from tradesmen or others supplying goods or selling property to, or doing work for, the Corporation. Any person who is found to have violated this rule shall, *ipso facto*, forthwith cease to hold his appointment.
>
> "That a copy of this resolution be sent to all persons and firms who now or may hereafter have an account with the Corporation in respect of the above matters."

Any tradesman or other person as aforesaid offending against the above rule will be liable to be debarred from entering into any future contract with the Corporation.

A Testimony to the Late Sir George Livesey.

A striking testimony to the life-work of Sir George Livesey comes from the electrical industry, in a lecture given to the students at the East London College by Mr. A. H. Seabrook, of the Marylebone Electric Undertaking, on "The Management of Electric Supply Undertakings (Staff and Employees)." Dealing with the portion relating to accidents, insurance, and sickness, and the Workmen's Compensation Act, Mr. Seabrook stated that there were cases of indirect effects of accidents to which the Act did not apply, and then went on to say: "Had every employer been a George Livesey, I am perfectly certain no such legislation would have been found necessary; and yet he found that he could apply altruism in employment, and at the same time make a huge success of his undertaking. In fact, I would go so far as to say that it is largely on account of his altruistic methods that he made his business a success." The correspondent to whom we are indebted for the above extract, remarks: Truly an interesting as well as a disinterested, at the same time a welcome, testimony to the life and labours of one we are glad to see honoured outside as well as in the industry to which he gave himself so freely.

Long Service with the British Gaslight Company.

An interesting ceremony took place at the city offices of the British Gaslight Company, Limited, at Norwich, on the 16th inst., when Mr. Thomas Glover, the Engineer and Manager at the Company's Norwich station, presented to Mr. H. P. Oakley, on behalf of the Chairman and Directors, a beautiful eight-day clock, bearing the following inscription:

> Presented to Mr. H. P. Oakley by the Chairman and Directors of the British Gaslight Company, Limited, on the occasion of his attaining fifty years' service with the Company.
> 1862. November. 1912.

A silver salver was also handed to Mr. Oakley by the Chief Clerk (Mr. C. G. Frost) on behalf of the Norwich staff. Mr. Oakley entered the Company's service in the year 1862, and after spending some time in the coke office at the St. Martin-at-Palace works, was transferred to the clerical staff at the Bishop Bridge works, and subsequently to the town offices. He has acted for many years as collector, and has earned the respect and esteem of both his brother officers and the Company's many clients with whom he comes into contact. This is the second occasion, within a short interval, of fifty years' service being completed at Norwich; Mr. Frost having been similarly honoured last year.

A REMARKABLE COAL-GAS ENGINE.

An article thus headed appeared in the issue of the "Electrical Review" for the 15th inst. As it was "communicated" to our contemporary, we asked permission to reprint it. This was at once granted; and the illustrations accompanying it were also placed at our disposal.

In these days, when our competitors abroad are devoting so much attention to the internal combustion engine, any outstanding development in this country deserves (and obtains) most careful attention. In this direction, the engine that has been invented by Dr. Archibald Low, D.Sc., for working on coal, has reached a point of development when it can already claim improved results over existing practice; and the fact that the writer was recently able to study the working of one of these engines, encourages him to think that the particulars then obtained may be instructive to others.

Crudely, the Low engine may be described as running on gas obtained from coal in a producing plant so compact that the complete plant constitutes nothing more than an elaboration of the cylinder-head casting. Obviously, gas production under such conditions necessitates a special system.

Although the idea which this engine embodies has been the subject of seven years' continual study and experiment, inevitably involving trials of various sizes of engines, for the present purposes the writer cannot do better than take for description the machine that he watched at work. This is a large single-cylinder 80 to 100 H.P. engine of the usual horizontal design, merely modified to meet the requirements of the special idea. To this end the 16-inch cylinder head has been replaced by a casting extending somewhat to each side of the cylinder. This casting is made up of various chambers. Looking at it from behind the cylinder, on the extreme left is the hopper chamber; and small coal is here fed by gravity into tubes that run through to the chamber at the other end of the casting. Through these tubes run coarse-pitch conveyor worms, ratchet-worked from the engine; and these work the coal along the tubes from the hopper chamber.

The engine is started up on ordinary town gas or any other available supply; and after a few minutes' running, these tubes, where they pass through the combustion head and through a chamber heated by the exhaust, become hot enough to raise the coal to incandescence.

The exhaust heated chamber is seen immediately to the left of the cylinder, while on the other side is the shoot chamber, from which the ashes, after being worked to the ends of the tubes, are free to fall into the ash-pit. The ends of the tubes are thus open to the air, which, coming up the shoot, passes over the incandescent fuel in the tubes and supports combustion.

In the 100-H.P. engine in question, four 2-inch tubes are used; and where they pass through the small space that exists between the hopper and the exhaust heated chamber, they are drilled with as many ½-inch holes as can be conveniently arranged in staggered formation. It is this small chamber that is connected with the engine inlet pipe, the suction from which draws the air and products of combustion to the engine in the form of air gas and coal gas; and this, before reaching the engine, is mixed with additional air admitted through an automatic valve placed close to the inlet valve. Earlier trials showed irregular running, owing to the pulsating action from the suction of the engine on a plant of such small volume capacity; and thus we find an india-rubber bag (seen in fig. 1) interposed between the gas plant and the inlet valve, to act as a damper and equalize the flow of gas.

The engine has been designed for the rather high compression of 90 lbs. per square inch, and this on purpose to give it a wider range of economical power; for though the compression is rather high for working on air gas and coal gas alone, the engine at 90 lbs. compression can quite well work on this mixture for a quarter of an hour or twenty minutes. If extra power is required for short periods on emergency loads, 15 to 18 per cent. more power can be obtained on this dual mixture than when working on the mixture which is obtained by the introduction of water drips into the producer pipes of the gas plant. On the triple mixture, compression up to 130 lbs. per square inch is quite feasible; and it is to permit of extra power from the dual mixture that the compression ratio is compromised at 90 lbs.

In normal working, the writer noticed that the engine was distinctly smoother in running than when town gas was used; and this can be accounted for by the molecular construction of the hydrogen in the coal gas and water gas being different—the former having a slower rate of combustion. Thus the pressure is well maintained through the stroke; and a good "fat" diagram should be possible. The engine ought to be economical. In fact, to judge by what the writer saw in this direction, the inventor will have no difficulty in substantiating his claim of 0·5 lb. of coal per brake-horse-power-hour—a figure which the writer believes has not hitherto been reached.

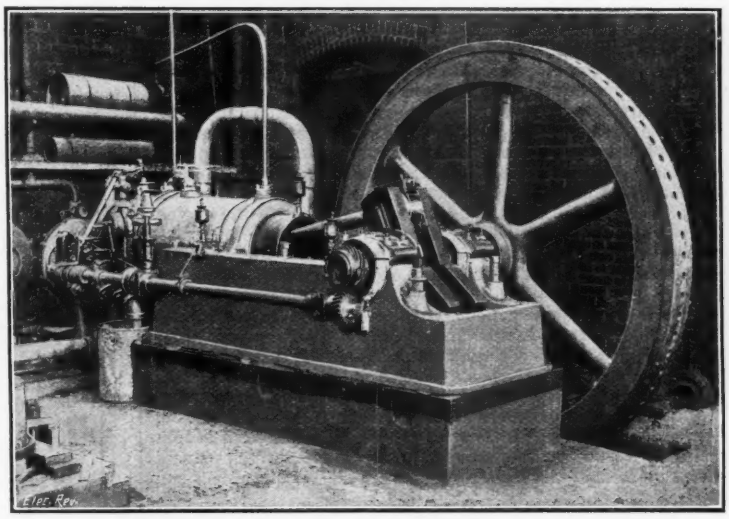


Fig. 1.—General View of the "Low" Coal-Gas Engine.

Attempts hitherto made to use coal for internal combustion without the addition of elaborate gas making and scrubbing plant, have practically invariably shown a tendency towards tarry deposit in the cylinder. But in the Low engine this trouble does not appear to exist, for the test cock showed that the gas given to the engine was mixed with a thick mustard-coloured smoke, which would not condense except under extreme cold or a combination of considerable cold and high compression, neither of

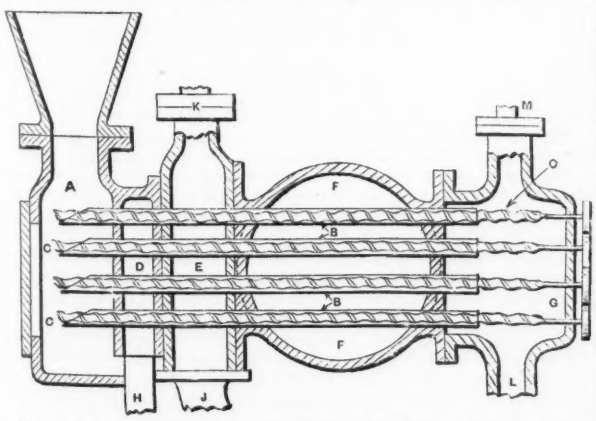


Fig. 2.—Diagrammatic Sketch (in Section) Showing the Principle of the "Low" Engine.

A Hopper chamber. B Gas generating tubes. C Conveyor worms. D Chamber where the gas is taken off to the engine inlet. E Exhaust heated chamber. F Cylinder. G Ash-shoot chamber. H Pipe to inlet valve. J Pipe from cylinder exhaust. K To silencer. L Ash-shoot. M Test-cock.

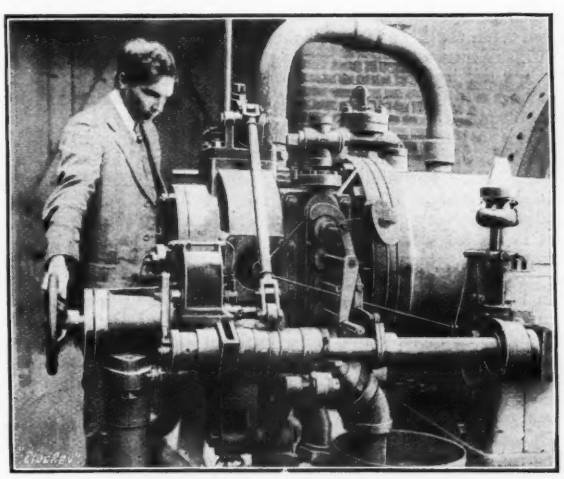


Fig. 3.—Cylinder Head Arrangement of the Coal-Gas Engine.

The figure in the photograph shows Dr. Low. The valve he is operating changes over the gas from town supply to the self-generating supply.

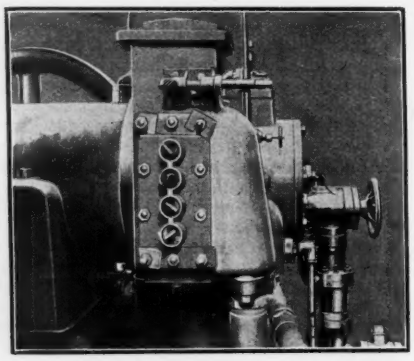


Fig. 4.—Combustion Head of the "Low" Engine, seen from Hopper Side.

The ends of the generating tubes and of the conveyor worms can here be seen.

which would be incurred in ordinary working. The piston, too, appeared to be perfectly free from deposit, although somewhat black; but this was due to the burning of the lubricating oil at the high compressions, and the consequent high temperatures of combustion in the cylinder. In fact, to this last may largely be ascribed the remarkable fuel consumption.

But, apart from the mere economy in fuel consumption, the Low engine promises to have a big future, owing to the simple fact that it utilizes the slack and small stuff of our coal supply—the least valuable grades of coal; nor with the larger size of engine need the coal be screened very carefully. Of course, the size of the fuel depends to some extent on the size of the engine. For cylinders of about 5 inches diameter with corresponding stroke, cubes up to ¼ inch would be quite large enough; while for the little 2-H.P. engine with which Dr. Low did much of his experimental work, the coal was scarcely coarser than coarse brown sugar. That the engine is not very exacting about its fuel supply, however, and has a wide range in this direction, is evidenced by the fact that it has been shown capable of running on such fuel as sewage.

One other point. In previous attempts to use coal gas in more direct ways than usual, trouble has often been experienced from the production of sulphuric acid. In this case, the acid is split up into hydrogen, sulphur, and sulphur dioxide, which causes nothing more than a slight pitting of the easily replaceable generator tubes.

The engine has now reached the phase of development when it leaves the experimental and enters upon the commercial stage; and if recent performances afford any criterion, it has a very great future before it, in small and large sizes.

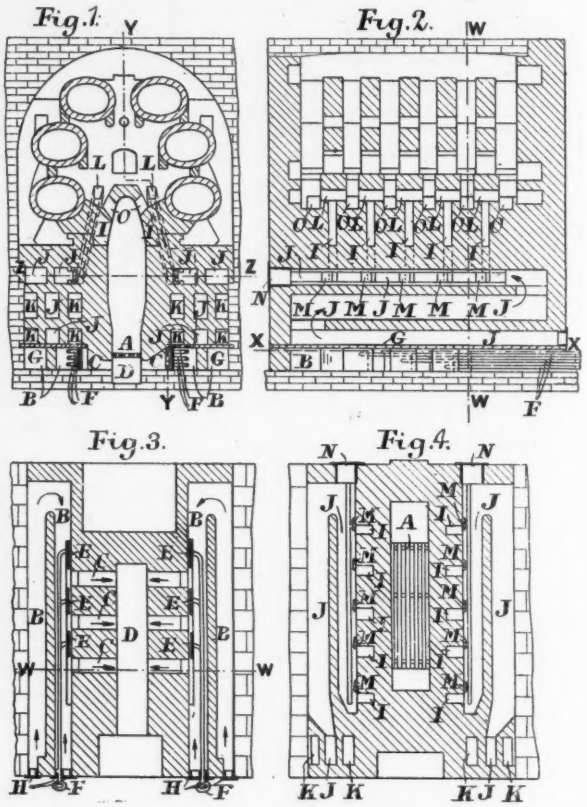
REGULATION OF RETORT TEMPERATURES.

One of the troubles experienced by gas managers and retort-house foremen arises from the irregular heating of the settings. This may be the result of variable liberation of gas from the layers of coke, or of irregularity in the introduction of primary and secondary air. But whatever the cause may be, the attendant inconvenience is one which it is desirable to obviate. An attempt to do this has been made by Heer J. G. Völker, who has devised a retort-setting which, as he claims, will be uniformly heated. His design, which is shown in the accompanying illustrations, has been patented for France; and the following particulars are translated from the French specification.

Fig. 1 is a section of a setting on the line W of figs. 2 and 3; fig. 2, a longitudinal section on the line Y of fig. 1; fig. 3, a horizontal section on the line X of fig. 2; and fig. 4, a horizontal section through the line *Z* of fig. 1.

Coke is burnt on the grate A in the usual way, and gasified. The primary air enters by the passages C, and is heated in the passages B. Through the former passages, it enters the space D under the grate. The system of construction in general use does not produce very uniform combustion; so that the liberation of gas is not regular. The setting under notice is furnished with dampers E, by means of which the orifices of the passages C may be partially or entirely closed. The positions of these dampers can be regulated by the rods F, to which they are connected. The passages B are closed at the top by metal plates G, so that the air is better heated in these passages than in the usual brick flues. This also helps to produce regular primary combustion. The passages B are fitted in the ordinary way with dampers H at the ends, which communicate with the atmosphere. They enable the quantity of air entering the compartments of the passages B to be controlled. Thus, by means of this system, combustion on the grate can be regulated as desired.

The inconveniences associated with the supply of secondary air are caused by obstructions in the passages I, which convey the air to the passages J, where it is heated by the combustion gases entering through the passages K. But the conveyance of air through the passages I is never regular, because when running through the passages I and J it meets with variable resistance; and the chimney draught does not act in the same way on all the outlet orifices L. It has been found very useful to furnish the lower ends of the passages I with regulatable dampers M, to control completely the quantity of air entering each passage I. These dampers are at so high a temperature that metal would be quickly destroyed. They are therefore made of refractory material; and their position is regulated by means of a hook run through an opening which can be closed.



In order that the diagrams may be better understood, it must be added that the gas liberated from the coke flows through openings O in the arch over the layer of fuel, to meet with the secondary air issuing from the passages L, and be completely burnt in the spaces between the supporting walls in front of the retorts, as shown in fig. 2. It is important to subject the full length of the retorts to a perfectly regular heat; and this is realized, in the arrangement described, by the employment of the dampers M and E, and by a proper heating of the air in the passages B.

Fire Inquests and Fires of Electrical Origin.

The members of the Insurance Institute of London formed a considerable audience in the Great Hall of Winchester House on Tuesday evening last. The attraction was a lecture by Dr. F. J. Waldo, the City of London Coroner. The City possesses the unique powers of holding fire inquests; and Dr. Waldo advocates the application of similar powers throughout the country, as he is convinced that they are a protection against the crime of arson, and against fraud on the insurance companies, and that they also assist in the elimination of preventable defects that may be the cause of fire. The history of these inquests and the effects was highly interesting. A few incidental remarks touched upon fires of electrical origin. In the reports that he receives daily from the Chief of the Fire Brigade, Dr. Waldo sometimes finds, under the heading "supposed cause of fire," the term "electrical." He does not, however, take it for granted that the supposition is true, because the Fire Brigade had to make a somewhat hurried determination of the matter, seeing that it is obligatory on the Brigade to send him notification of every fire in the City within twenty-four hours after the occurrence. For some years past he has had the valuable assistance of the City Electrical Engineer; and this has helped him to arrive at the conclusion that, of the fires supposed to have had electrical origin, there has been an average during the past few years of thirteen fires a year in the City. Speaking from memory, there were in 1910 nineteen fires that had electrical origin, due to defective equipment.

A Reuter message from Stockholm announces that the Swedish Royal Academy of Sciences have awarded the Nobel Prize for "Physics" for 1912 to M. Gustaf Dalen, the Chief Engineer of the Stockholm Gas Company; and the prize for "Chemistry" has been divided between Professor Grignard, of the Nancy University, and Professor Sabatier, of the Toulouse University.

NEW MANTLES FOR INVERTED BURNERS.

In the manufacture of mantles for inverted burners, a pipe-shaped piece of artificial silk, cotton, or similar material, is cut to the required length, and closed at the extremity to form the bottom of the mantle. This is done by drawing together the meshes with one or more threads, and gathering the tissue upon them. This method of proceeding is defective, owing to the fold formed in the mantle; the principal drawback, especially with artificial silk, being the necessity for subjecting the mantle to preliminary burning-off at a relatively high pressure. Doing this on the burner with which the mantle is to be employed—*i.e.*, a low-pressure one—will not remove the wrinkles and folds, because the pressure is too slight to inflate the mantle, which is composed of oxides mixed with organic matter. Consequently, after the disappearance of the cellulose, the mantle retains its wrinkles, to the detriment of its light-giving power. On the other hand, when the mantle has been burnt-off at high pressure, it is inflated like a balloon, and this partially removes the wrinkles, and imparts additional lighting power. The preliminary burning at high pressure has the great drawback of only being applicable in the factories; and this makes subsequent carriage of the mantles difficult, and considerably increases the price. Moreover, the operation entails a large consumption of gas.

A method of incandescent mantle manufacture by which the inconveniences mentioned are said to be avoided has been devised by M. Achille Marie Plaissetty, who has patented it for France. The specification, which has recently been published, furnishes a description of the method, accompanied by the following illustrations: Fig. 1 represents a piece of tubular fabric cut according to the invention; fig. 2, a mantle made from the fabric, and stitched in the manner explained by the patentee; and fig. 3, a mantle made according to another method of carrying out the process.

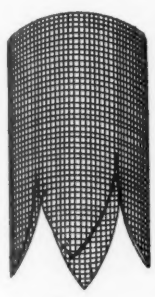


Fig. 1.

Fig. 2.

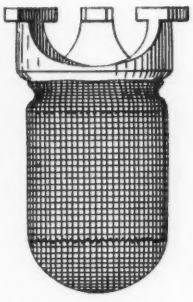


Fig. 3.

The method of manufacture is as follows: The piece of fabric, of the proper length, is cut out at one end so as to form several points, as shown in fig. 1. All that has to be done is to stitch the points together to obtain a round or oval mantle absolutely free from folds, as represented in fig. 2. Among the advantages claimed for the process is a great saving of labour. A skilled workwoman can make 100 mantles daily by the ordinary method, whereas it is stated that she can produce from 350 to 450 by the new process; the cutting and stitching being rapidly executed with special machines. A similar, though less profitable, result can be attained as follows: The fabric having been cut to the required length, an end of the same material is machined on to the edge of one extremity; and the mantle shown in fig. 3 is the result. The invention is not restricted to the forms described, which are merely given as examples.

Institution of Water Engineers.

The winter general meeting of the Institution will be held in the apartments of the Geological Society, Burlington House, W., on Saturday, the 14th prox. According to the circular issued by the Secretary (Mr. Percy Griffith, M.Inst.C.E.), the business will consist of the election of the Council for 1913-14 and of new members, and the reading of the following papers:

"Some Recent Examples of Pollution of Public Water Supplies," by J. C. Thresh, D.Sc., M.D., &c.

"The Valuation of Water Undertakings on Transfer to Local Authorities," by Mr. E. J. Silcock, M.Inst.C.E.

"Recent Advances in the Science of Water Purification," by Adolph Kemna, D.Sc.

The ordinary business will be taken after a special general meeting called for 10 a.m.; and the usual informal dinner will be held the preceding evening.

The Indiana Steel Company, of Gary (U.S.A.), have been experimenting with the use of tar as a fuel for their open-hearth furnaces in place of producer gas. The result of these operations appears to have been successful, as two furnaces are being operated exclusively with tar. It is used in its liquid state, as it comes from the bye-product coke-oven plant, and is handled very much like fuel oil. The burners are similar to those used for oil, and the tar is atomized with steam.

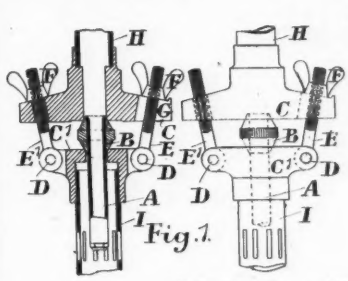
REGISTER OF PATENTS.

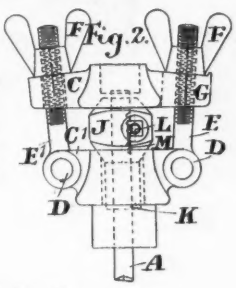
Gas-Lamps.

HELPS, G., of Atherstone.

No. 16,835; July 22, 1911.

Fig. 1 shows the general arrangement of this invention in section and elevation. The nipple-tube A has a collar or block at B; while C and C^1 are flanges having hinged or knuckle joints D. The screwed pin on the left passes through a hole in C and is secured by the wing nut F.





Helps' Gas-Lamp Attachment.

The pin E on the right-hand side swings into a slot G, so that as the wing nut is slacked the pin may be thrown out of the slot and so allow the lower flange C^1 to drop to such an angle that the collar B is clear of the upper flange connection, and can be rotated on the pin E^1, which enables the tube A to be drawn out. The upper flange C is connected to a gas-pipe H, and the lower flange connection C is attached to the tube I, to which the burner is secured. When the nipple-tube is replaced, the lower flange connection is turned on the pin E^1 until the block B is in such a position as will allow the screw pin E to be thrown into the slot G; and then the two wing nuts may be tightened-up so as to make a gas-tight joint between the flange connection C and C^1.

Fig. 2 shows, in elevation, a similar arrangement; but in this case the nipple-tube A is connected to a block J, in which a stuffing-box at K is contained, and a pinion L works on a rack M cut into the nipple-tube. Thus, without disconnecting, the nipple-tube may be raised or lowered in the burner-tube, and so the opening between the burner-tube and the nipple may be closed or opened to regulate the quantity of air injected into the burner by the nipple, as described in patent No. 18,887 of 1908.

Testing Pipe-Joints.

SCHOMBURG, L., of Gelsenkirchen, Germany.

No. 24,117; Oct. 31, 1911. Convention date, Nov. 1, 1910.

This invention relates to an arrangement for testing the packing of pipe-joints; and in the illustration (p. 684) are shown several forms of socket-and-spigot joint-packing made according to it.

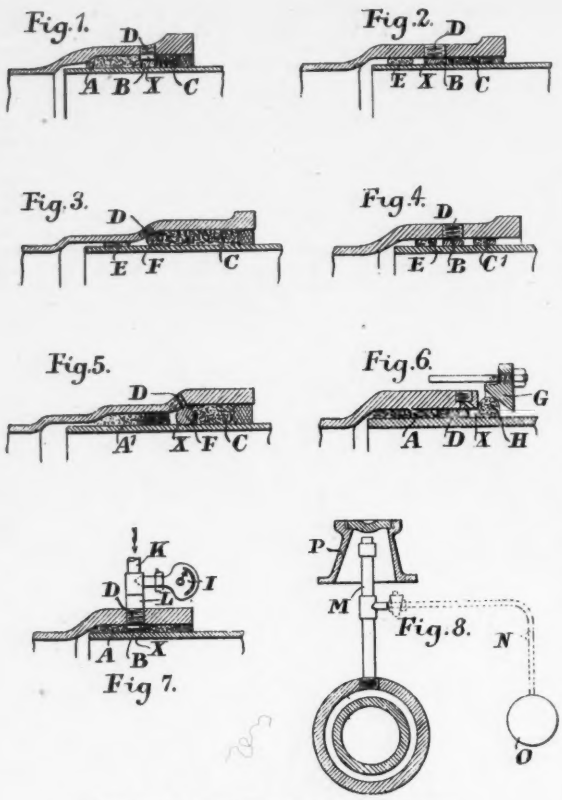
In fig. 1 (a socket having two recesses of different diameters), there is arranged at the base of the socket an inner packing A, of hemp-gasket or the like; on this lies an intermediate rigid ring B, of cross section, not filling up the socket; and then follows the outer packing C, of hemp-gasket, with lead, cement, or the like applied in front of it. The space between the two packings is accessible from the exterior through a closable hole D.

Fig. 2 shows a socket having only one internal diameter. As the inner packing, an indiarubber ring E is adopted; in front of this lies an intermediate ring B, which guides the inserted pipe or spigot centrally; and then follows any suitable outer packing C, as in fig. 1. In both forms, the ring B serves as an abutment for the outer packing. In the double socket shown in fig. 3, there is provided in the inner recess of the socket an indiarubber ring E forming the inner packing. At the base of the outer socket lies a ring F; and on this lies the outer packing C. The hole D lies behind the base ring F. In fig. 4, two indiarubber rings E C^1 are provided as inner and outer packing, together with an intermediate ring B.

Fig. 5 shows a socket having three internal diameters. The innermost recess of the socket here serves for guiding the pipe or spigot inserted in it. In the middle recess of the socket is the inner packing A^1, consisting of hemp-gasket and lead-wool; and at the base of the outer recess is a ring F (as in fig. 3), on which lies the outer packing C, consisting of hemp-gasket and lead. The intermediate space X, with the hole D, lies behind the base ring F. Fig. 6 shows a construction in which a packing ring H, pressed up by the flange G and screws, serves as the outer packing. This ring rests against the outer edge of the socket, in which the hole D is provided.

Fig. 7 shows the connection with the pipe L leading to the intermediate space X, of a pressure-gauge I, and a pipe K leading to an air-pump. Fig. 8 shows the application of a testing-pipe M and a branch pipe N, through which any gas that may escape through the inner packing of a high-pressure gas-pipe can be conducted away into a low-pressure gas-pipe O. The test-pipe M is covered by a surface box P.

The laying, repair, and testing of the packing take place in the following manner: If the inner packing is made, it can be tested from the hole by applying a force pump provided with a pressure-gauge (fig. 7), if the outer part of the socket be closed by a temporary packing, such as that shown in fig. 6. The outer packing is only made when the inner packing has been shown to be tight. The testing of the outer packing is effected by means of the hole in the intermediate space. Also by making the inner packing good by an indiarubber ring, the separate testing of the inner packing can be dispensed with and the outer packing inserted at once; the two packings being tested together from the intermediate space, in which operation the outer packing can



Schomburg's Pipe-Joint Testing Arrangement.

be coated with soapy water, so that if any gas escapes bubbles are formed.

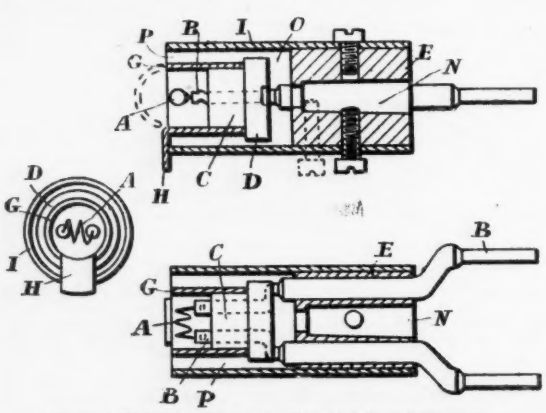
If it be desired to detect leakages as they occur, a testing-pipe can be led from the hole at the intermediate space to a convenient point on the surface—for example, to a surface box, fig. 8, from which the testing can take place at any time. It is also possible with high-pressure gas-pipes to make a connection of the intermediate space of the multi-part socket with a low-pressure gas-pipe, in order that the gas forced out from the inner recess of the socket by the high pressure shall not be lost. This "process also permits the pressure in high-pressure gas-pipes to be made considerably higher than has been heretofore considered advisable, in view of the leakages of gas to be feared."

Electrically Igniting Gas.

HAVERS, E. W., of Highgate, N., and the TELEPHOS DOMESTIC AND STREET LIGHTING COMPANY, LIMITED, of Farringdon Avenue, E.C.

No. 24,448; Nov. 3, 1911.

This invention relates to a device for the ignition of gas from a distance by means of an electric current, and is "more especially applicable to burners which are supplied with high-pressure gas." It consists of "an improved form of igniter which is reliable in its action, simple and economical in construction, readily removable for repairs or renewal, and is so arranged that the delicate platinum or other incandescent filament is effectually protected from the impingement of the flame thereon, and rendered free from shock, whereby the life of such filament is considerably increased."



Havers' (Telephos Company) Gas-Lighting Apparatus.

As shown, the igniter (in one of its forms) consists of a platinum filament or coil A, the ends of which are electrically connected to the ends of small conductors B, (preferably of tubular form), with the ends of the coil secured by crushing-in the tube ends. The conductors are fixed in a porcelain or other non-conducting cylindrical plug C, (say) by causing the flattened and outwardly bent Z-shaped portions to be embedded in recesses in the inner end of the flange D of the plug. The conductors then pass through two longitudinal holes prepared for them in a cylindrical metal plug E, one end of which is a short distance only from the surface of the flanged end of the porcelain plug. G is a metal guard tube secured to the plug C and surrounding the ends of the conductors. The outer end of the tube preferably extends sufficiently beyond the ends of the conductors as to form a protector or guard for the coil. This end of the tube is preferably furnished with radially projecting members H, which extend outwardly more or less at right angles to the tube. I is an outer containing tube or sleeve, one end of which bears against the inner side of the radially projecting members H, while the other end fits closely the plug E, and may conveniently terminate at the end of the plug. The metal plug E has a third longitudinal hole N to receive the gas supply fitting to which it may be secured by clamping screws.

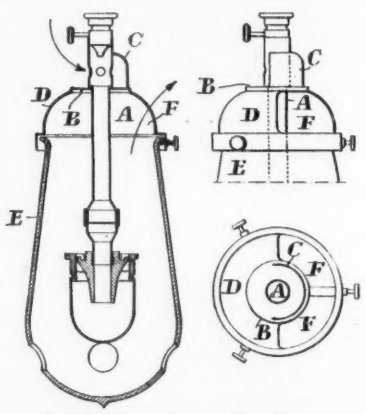
Gas is admitted through the fitting in the hole N in the metal plug E into the space O between the inner end of the plug and the flanged end D of the plug C, which latter, being of less diameter than the tube or sleeve I which surrounds it, allows the gas to flow past the flange D into the annular space P between the outer tube or sleeve and the guard tube G on the plug C. The gas then flows through the spaces between the radially projecting members H of the guard tube and also impinges against the inner sides of the members H; the effect being to check and deflect the flow of gas and cause it to burn on the outer open end of the tube G—the ignition being effected by the filament or coil which has been made incandescent by an electric current. As, however, the coil is not brought into contact with the direct flow of gas, nor with the gas flame after it has been ignited, it is not affected thereby, and is "consequently rendered more certain in its action, and its life is considerably prolonged." As soon as the gas flame has ignited the gas issuing from the main burner, the gas supply to the igniter, and the electric current to the filament or coil, are automatically shut off in any convenient manner.

Incandescent Gas-Lamps.

VERGNES, L., of Paris.

No. 24,918; Nov. 8, 1911. Convention date, Nov. 8, 1910.

This inverted burner is constructed in such a manner that the combustion gases are not mixed with the fresh air drawn in through the injector of the burner. It is said to be an improvement on burners of the kind in which the outlet for the combustion gases is provided in one side of a cap and the inlets for the air are formed on the opposite side of another cap surmounting the first cap—the inventor proposing to form the outlet and inlet apertures by cutting away one-half of each cap. This, it is said, "ensures a steadier flow of the air and gases and a steadier flame."



Vergnes' Incandescent Gas-Lamp.

On the mixing-tube A below the injector and air admission holes, a plate B is fixed which carries on the top a hood C, and underneath it a hood D of larger diameter. The hood C encloses the air admission holes on one side and is open on the other. On the other hand, the hood D is open on the opposite side; so that it forces the burned gases to escape opposite the air inlet in the hood C. These burned gases are collected in the hood D by a globe E suspended from the hood. The gases discharged through the opening F on the side where the hood C is closed cannot mix with the fresh air which reaches the injector through the opposite opening in the cap C. The plate B with the two hoods is "particularly intended to isolate the burned gases from the air that enters by directing the former on to one side of the burner and limiting the access for the air to the opposite side."

Volumetric Gas-Governors.

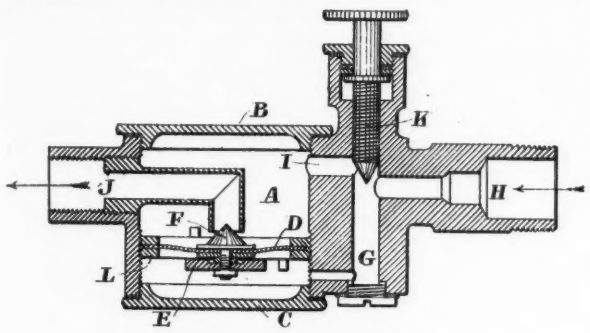
PALMER, W. V., of the South Metropolitan Gas Company, Old Kent Road, S.E.

No. 26,615; Nov. 28, 1911. Redated May 20, 1912.

This gas-governor is of the kind which comprise a cylindrical box divided transversely by a diaphragm into two chambers, each of which has an inlet from the gas supply and one of the chambers has also an outlet leading to the place of consumption, which outlet is controlled by a plug or valve carried by the diaphragm. The action of the apparatus is "to maintain the discharge of a regular volume of gas irrespective of the pressure in the main." The apparatus "can be easily opened for adjustment," and can be "cleaned without disturbing any of the adjustments which have been made."

A is an open-ended chamber closed top and bottom by screw caps B C. D is a flexible diaphragm extending across the chamber, and

dividing it transversely into two parts. The diaphragm is loaded with weights E to any desired extent; and it also carries on its upper side a conical plug F. The lower part of the chamber has an inlet G open to the gas supply H, but no outlet; and the upper portion of the chamber has an inlet I from the gas supply, and also an outlet through the pipe J, the end of which forms, with the plug F, the outlet valve. K is a screw which regulates or cuts off the gas supply.



Palmer's Volumetric Gas-Governor.

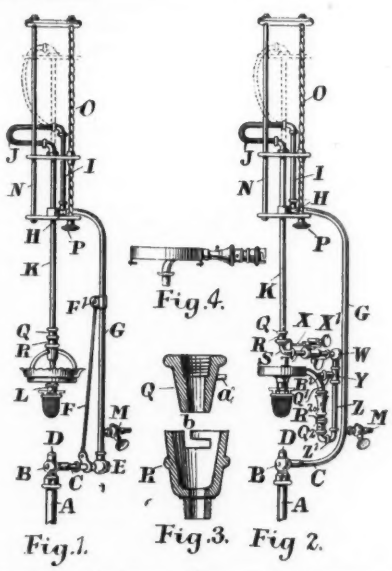
The diaphragm is carried on a ring L, which screws into the interior of the chamber so that an adjustment is provided for positioning the plug F with regard to the mouth of the pipe J, or for enlarging or diminishing the capacity of the compartments of the chamber. By unscrewing either of the caps B or C, the interior of the governor is accessible.

Photometrically Testing Gas-Burners.

GORDON, W., of Edinburgh.

No. 27,978; Dec. 13, 1911.

In testing burners, the patentee remarks, it is important that their position relative to the apparatus on the photometer should be capable of accurate adjustment, both as regards height and position horizontally, and at the same time to allow of a rapid change of burner irrespective of its design or pattern. To carry out this object, he proposes to fix on the usual burner standard of the photometer, or on a special standard of similar type, a swivel joint, allowing of radial movement horizontally of the tube attached to it. He also provides, on the upper end of the plug of the swivel, a passage through which the gas can pass vertically upwards; and there is a screwed cap to close the passage when not required.



Gordon's Attachment of Burners to Photometers.

Fig. 1 shows one method of carrying out the invention. A is the usual burner standard of a photometer; and B the swivel joint allowing of radial movement horizontally to the tube C attached to it. D is the screwed cap, closing the passage through which gas can pass vertically upwards when required. E is the angle swivel joint with bracket and stretching rod F, so that the vertical pipe G can be clamped by a sliding clip and screw at any angle, or a bend may be used to connect the pipes C and G as shown in fig. 2. This pipe G is bent in a horizontal direction, thus bringing the end H almost immediately over the first swivel joint B. At the point H a bend is used to convey the gas through the vertical pipe I, and a bend to the flexible tube J, to the other end of which is attached a second elbow and tube K, passing vertically downwards. This tube passes through an eye near the bend H, through which it is free to move vertically up or down. At the eye at H is attached a vertical rod N for guiding, and the vertical thread or screw O, so that the pipe K and burner L may be raised or lowered by the turning of the button P, or a rack may be attached in place of the vertical thread or screw O and a pinion geared into it and worked by a milled head near the button P. To the lower end of the tube K a hollow conical taper plug Q is attached, with a pin on its side with the body R attached to it by a bayonet joint. This conical taper plug Q and body R are shown in detail in fig. 3, where Q is the taper plug with pin, and R is the body with a hole inside of similar taper.

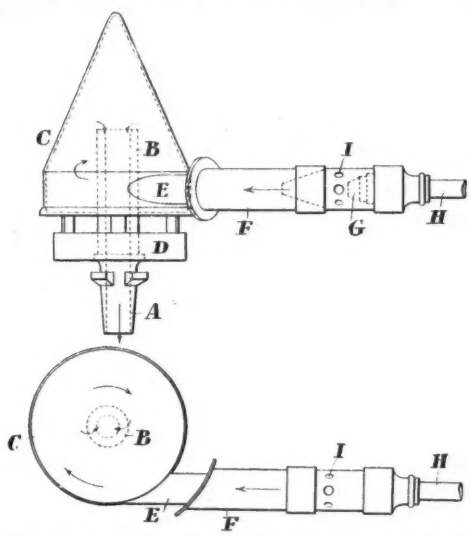
Fig. 2 shows the method of attaching a burner with either horizontal or vertical supply. For this purpose, an elbow S is fitted to the body R upon the end of the tube K, and a short length of tubing T running horizontally to a stuffing-box U to which is attached a short length of larger tube and angled swivel joint W. To enable the tube T to pass into and out of the stuffing-box U, a rack and pinion X are operated by a button, so that the swivel joint W can be fixed at any required distance from the second tube K. To the lower end of the swivel joint W is attached a T piece Y with a hollow taper plug, to which is attached some form of body with a tapered hole and bayonet joint, upon which can be screwed a burner requiring horizontal connections, as shown in fig. 4. To the T piece Y is also attached a further piece of tubing Z, with a U bend for burners requiring upward vertical connection.

Atmospheric Gas-Burners.

SOUTH METROPOLITAN GAS COMPANY, and CHANDLER, D., of Old Kent Road, S.E.

No. 1559; Jan. 19, 1912.

The object of this invention is "to provide improved means whereby rotary motion may be imparted to the mixture of gas and air in atmospheric gas-burners and maintained up to the point of ignition." It is applicable to incandescent gas-burners, both upright and inverted, and also to gas-fires and to atmospheric burners generally.



Chandler's (South Metropolitan Gas Company) Atmospheric Burner.

The burner A is carried at the end of a tube B, inserted centrally into the conical chamber C (through the base) and extending some distance beyond the latter. D is a deflector (preferably of refractory material) for protecting the base of the conical chamber from excessive heat. Into the side of the chamber E, near the base, and in a tangential direction, is introduced a pipe E, which connects the interior of the chamber with a mixing-tube F. At the opposite end of the tube is the gas-injector G connected to the gas-pipe H.

The air and gas pass along the tube F into the chamber C, where the mixture swirls round, and, after being thoroughly mixed, escapes through the tube B to the burner. The arrangement "is such that not only is the mixture heated, but it is delivered in a state of rotation, so that the rotary motion is maintained right up to the point of combustion." The result is that "lighting-back is prevented, and a thorough mixing of the gas and air is effected."

Washing Gases.

LYMN, A. H., of Queen Anne's Chambers, Westminster.

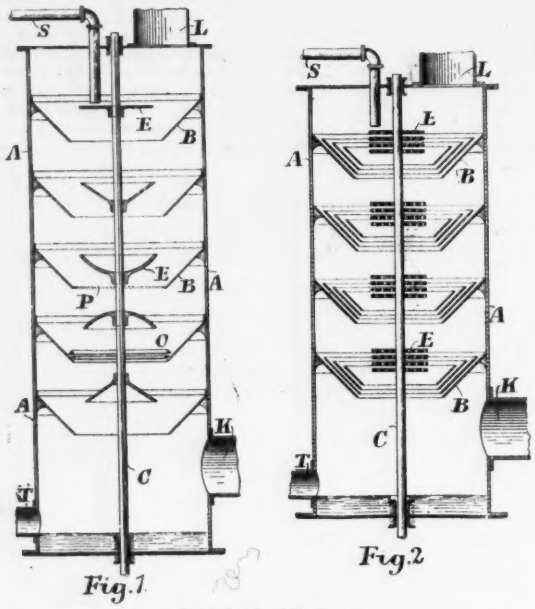
No. 11,452; May 14, 1912.

This present invention relates to a method of washing gases with liquids in a vessel or tower in which the washing liquid passes downwards while the gases pass upwards. It consists in utilizing the momentum of the flowing gas itself to throw the liquid from fixed inverted truncated cones or like collecting devices on to, or towards, the centre of revolving discs, in such manner that "during this period an efficient atomizing action is obtained, which provides a thorough washing action also during this period and, further, the momentum of the gas thus ensures a more thorough atomizing action of the liquid leaving the rotating discs."

Two sections of different forms of apparatus are shown on p. 686. A represents a cylinder to which inverted, truncated cones B are fixed in suitable positions. C is a shaft which passes through the openings of the cones and carries distributing devices E, in the form of cones, discs, or mushrooms, or any other suitable shape or curvature. The cones B, fixed to the cylinder and the distributing devices E carried by the shaft, are placed alternately. The gases enter at the bottom at K and leave at the top at L, whereas the liquid enters through the pipe S and leaves through the pipe T.

In the form shown, the fixed cones B, or other collecting devices,

and the revolving distributing devices E, are of such relative size that the liquid does not directly fall from the collecting devices B on to the revolving distributing devices. Furthermore, the fixed collecting devices are of such size and are so constructed that the liquid leaves them in one or more relatively thin layer or layers. Thus the gas passing through the apparatus is enabled to thoroughly atomize the liquid coming from the collecting devices and throw it, in an atomized condition, towards the centre of the apparatus upon the whole of the revolving distributing devices E.



Lymn's Gas Washers.

The additional means for subdividing the layers of liquid leaving the fixed cones B into thin or broken walls may assume various forms. For instance, they may consist of bands O, as in fig. 1, for the second last cone. These bands may be triangular in section, with the apex towards the current of liquid, in such manner that a part of the liquid will flow over the bands, or they may be provided with elongated perforations. Or the bottom of the cone may be provided with serrations P, through which the liquid is divided into strips. Similar means may also be employed for the revolving distributing devices E.

Fig. 2 shows another form of the apparatus. Here the revolving distributing devices consist of a number of superimposed perforated discs, between which the liquid is thrown outwardly in superimposed layers. Instead of one fixed cone, four co-axial cones are arranged, through which the liquid streams in thin layers, and offers a very considerable contact-surface to the gases.

Separating Thorium from Other Rare Earths.

DEUTSCHE GASGLÜHLICHT AKTIENGESELLSCHAFT (AUERGESELLSCHAFT), of Berlin.

No. 15,919; July 8, 1912. Convention date, Aug. 17, 1911.

This process for precipitating and separating thorium from other rare earths is based partly on the results of Kauffmann's experiments, which showed that the thorium salt of hypophosphoric acid ($H_4P_2O_6$) is insoluble in water, in acids, and in alkalies, and partly on the fact, "now ascertained for the first time," that the other rare earths form exceedingly easily soluble compounds with hypophosphoric acid.

An example of the process forming the subject of the invention is given as follows: The solution obtained from 10 kilos. of monazite sand by treatment with sulphuric acid is mixed with 650 grammes of sodium hypophosphate. The precipitate obtained is then further treated in the known manner.

The great advantage of the process is said to be the ease with which the separation of the thorium from the other rare earths and from the phosphoric acid present in the monazite sand is effected. Known methods of precipitating the other rare earths and the phosphoric acid are "much more circumstantial and costly."

Burners for Gas Fires, Radiators, and Cooking Stoves.

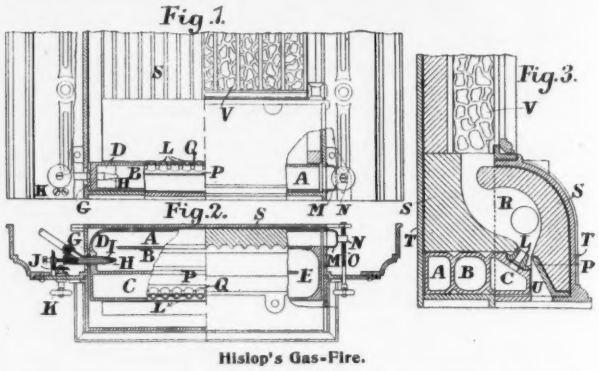
HISLOP, GEORGE R., of Paisley.

No. 12,636; May 29, 1912.

This invention relates to burners of the type in which gas is injected through the closed end of a tube so as to draw-in air for combustion through an adjoining tube and force the mixture of gas and air through the first-mentioned tube and one or more remaining tubes before passing to the point of combustion. It provides a regulatable valve for controlling the admission of air into one compartment and an injector for directing a regulated flow of gas into an adjoining compartment.

Fig. 1 is a part elevation and part vertical section of a portion of a gas-fire equipped with the improved burner. Fig. 2 is a part plan and part horizontal section. Fig. 3 is a vertical section at right angles to fig. 1.

The patentee proposes to fit together a plurality of hollow or tubular interconnected members A, B, C (of suitable length and cross section) affording compartments in constant communication with one another by openings D E. Through the closed end G of the member B is inserted a gas-injector comprising a nozzle H, within which is fitted an adjustable needle regulator I, including a screw-threaded portion adapted to be operated as by means of bevel gearing J from a manually-controlled rotatable element K, so as to permit an agreed volume of gas to be passed in a given time, independently of the main gas-controlling tap. When the tap is opened, the gas issuing from the nozzle H serves to induce air to enter through the tubular member A and so mix with the gas supply, the mixture of gas and air passing thence through the tubular members B C, or through a greater number of such tubular members, to the burner-nozzles L, becoming heated on the way. The air supply to A is controlled by an adjustable slide-valve M provided with an extension N in screw-threaded engagement with a manually-controlled rotatable spindle O. The volumes of gas and air supplied to the burner can thus be accurately and independently adjusted, and the action of the gas issuing from the injector nozzle has the effect, it is said, in inducing the inflow of air to support combustion, "of completely destroying the disagreeable hissing noise inherent to gas-burners hitherto applied to gas-fires and the like."



Hislop's Gas-Fire.

The spaced burner-nozzles L are preferably of ¼-inch to ⅜-inch bore, and may be formed integral with a plate P, which is detachable from the burner body proper, and strengthened by ribs Q. Or the nozzle-plate P, which is of suitable breadth and extends substantially the full length of the tubular member C, may be fitted with detachable nozzles. The nozzle-plate is located over a longitudinal opening in the crown or side of the burner body proper. A renewable strip of wire gauze is preferably placed beneath the detachable nozzle-plate to prevent back-firing.

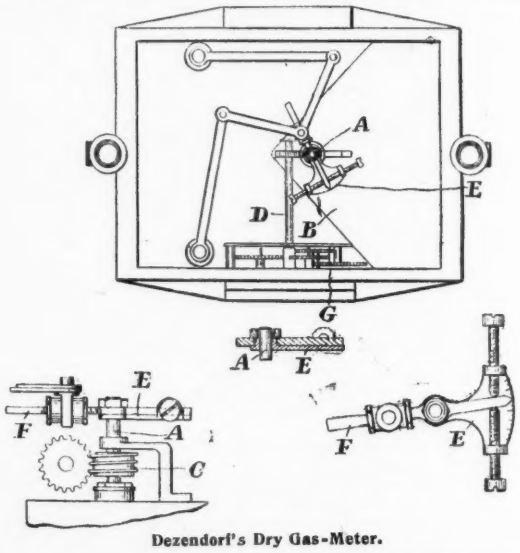
The burner shown is adapted to the gas-fire described in patent No. 23,657 of 1908, including a gyratory combustion chamber R made up of fire-clay tiles S and having a metallic casing T provided with an inlet, or inlets, at U for the admission of secondary air to the combustion chamber.

Gas-Meters.

DEZENDORF, R. L., of Richmond Hill, New York State.

No. 15,467; July 2, 1912.

This invention relates more particularly to meters provided with means for adjusting the tangent post angularly relatively to the crank-shaft, so as to vary the relations of the flag-arms to the crank-shaft.



Dezendorf's Dry Gas-Meter.

The meter shown has the usual flag-wires and flag-arms. A is the crank-shaft operating valves in the usual manner within the chamber B. C is the worm carried by the crank-shaft, with which a gear engages, which, in turn, through the rod D, actuates the registering train. To the upper end of the crank-shaft is rigidly secured a projection E, having two ears with screw-threaded perforations, through which pass screws. Concentric with the shaft, and preferably on a boss secured to the projection E, is mounted a tangent arm F, with rear extension, post-carrier, tangent post, and adjusting nuts. The nuts

afford means for adjusting the tangent post longitudinally of the arm in the ordinary manner. The arm is free to move about the axis of the crank-shaft and relatively to the projection E. The extension G lies between the ends of two screws; and by unscrewing one and screwing the other inwardly, the tangent can be turned through a considerable angle relatively to the crank-shaft and securely held in any position in which it may be placed—thus varying the relations of the flag-arms to the crank-shaft. The tangent is held against movement longitudinally of the crank-shaft by a nut (preferably screw-threaded) upon the boss of the projection E.

In operating the device, when it is desired to adjust the tangent post angularly relatively to the crank-shaft, one of the screws on the extension G is loosened and the other screw is tightened so as to move the extension the proper distance in the proper direction, and hold it rigidly in its adjusted position.

Incandescent Burner Arrangements.

SVENSKA AKTIEBOLAGET GASACCUMULATOR and DALEN, G., of Stockholm.

No. 13,136; June 4, 1912.

This invention refers to an incandescent gas-burner arrangement comprising a number of burners supplied with a gas and air mixture from apparatus common to all the burners; a cock being arranged in the main conduit connecting the mixing apparatus with the burners, so as to control the gas-mixture supply to all the burners simultaneously. A smaller pilot supply conduit places the portion of the main conduit at one side of the cock in communication with the portion at the other side of the cock, so that the main conduit supplies gas mixture to all the burners for establishing pilot flames in them, when the cock is closed. The burners are of the kind described in patent No. 23,930 of 1911—see "JOURNAL" for July 16, p. 196.

APPLICATIONS FOR LETTERS PATENT.

25,794.—KITCHEN, J. G. A., and STOREY, I. H., "Bunsen burners." Nov. 11.
25,811.—ROLLASON, A., "Manufacture of coke." Nov. 11,
25,820.—DUNPHY, A. L., "Inverted burners." Nov. 11.
25,829.—KEITH, J. & G., "Gas-heated hollow-ware." Nov. 11.
25,927.—RUDGE, C. D., "Self-closing cocks." Nov. 12.
25,935.—CHARLTON, J., "Treatment of acids." Nov. 12.
25,959.—KOLÁR, N., "Record printing and registering apparatus for meters." Nov. 12.
26,037.—MORTLEY, G. E., "Petrol-gas apparatus." Nov. 13
26,038.—VILLIERS, E.C., "Leak stoppers." Nov. 13.
26,046.—MOFFAT, ROSS, AND CO., LTD., and NEUMEISTER, C. W., "Packing mantles." Nov. 13.
26,054.—MARSH, R. G., "Gas-meters." Nov. 13.
26,062.—KRUMMLING, M., "Packing mantles." Nov. 13.
26,077.—STOLTE, A., "Filtration of gases" Nov. 13.
26,106.—LOW, A. M., "Gas-generators." Nov. 14.
26,127.—CROSSLEY, Sir K. I., and FIELDEN, F., "Suction-gas producers." Nov. 14.
26,128.—CROSSLEY, Sir K. I., and FIELDEN, F., "Gas-producers." Nov. 14.
26,134.—SHARPE, W. C., JUN., "Connecting flexible tubing." Nov. 14.
26,156.—SOUTH METROPOLITAN GAS COMPANY and SOMERVILLE, J. M., "Electric igniting means for gas-burners." Nov. 14.
26,161.—CONSTANTINESCU, G., "Obtaining gaseous fuel." Nov. 14.
26,243.—HULME, G., and BOOTH, J., "Gas-fittings." Nov. 15.
26,301-2.—NELSEN, H., "Making gas and coke." Nov. 15.
26,310.—HILTON, J., "Joints for pipes." Nov. 15.

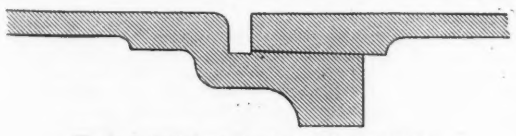
CORRESPONDENCE.

[We are not responsible for opinions expressed by Correspondents.]

Turned-and-Bored Cast-Iron Pipes.

SIR,—In reference to the paper read by Mr. W. G. Head at the meeting of the Southern District Association of Gas Engineers, on "Pipe-Jointing and Main-Laying," held on the 14th inst., and Mr. Charles Carpenter's remarks thereon, as reported in your issue of the 19th inst., I would beg the hospitality of your columns for the following observations.

With regard to cast-iron pipes, having turned-and-bored joints, the earliest notice I can find is in a report dated May 1, 1827—85 years ago—made by the late Mr. Alfred King, M.Inst.C.E., Engineer to the Liverpool Gas Company, to his Directors, stating that he had visited Dudley and placed an order for 578 yards of 9-inch pipes with Messrs. Grazebrook, and 420 yards of 8-inch with Messrs. Salisbury, and that the pipes were to have turned-and-bored joints to his own design.



Six-Inch Cast-Iron Bored-and-Turned Pipe.
[One-third Scale.]

This joint was used in Liverpool for all sizes of pipes until 1864, when I considerably reduced the width of the turned-and-bored surface; no other alteration being considered advisable. I enclose a full-sized drawing of a 6-inch pipe as then altered, and as used in Liverpool today.* No trouble has ever resulted from changes of temperature, or from heavy traffic; and the joints have not "drawn" owing to subsidence of ground.

It may be interesting to state that in 1903, in consequence of work being carried out by the Corporation of Liverpool, a considerable number of 16-inch pipes were taken up, which had been laid in 1850; and after more than half-a-century the red-lead jointing paint was brilliant in colour, and not the slightest trace of leakage could be discovered. These pipes were soon afterwards relaid, and are now in use. A sample of the paint has been kept; and my successor, Mr. Edward Allen, would be glad to show it to any one who might care to examine it.

On looking at the drawing, it will be seen that by cutting off the spigot at the back of the shoulder, the body of the pipe can be inserted in the socket, and an ordinary lead joint made. By this means, a considerable deviation from a straight line can be obtained, and the main laid along a winding road.

It will also be noticed that there is a recess at the bottom of the socket, which permits of a slight variation in the turning and boring, should such occur, without any risk of the pipe coming in contact with the bottom of the socket. When the joint is properly made, a certain proportion of the spigot projects beyond the socket; so that the pipe-layer can notice at once whether there is any irregularity.

This joint has been very successfully used from 1827 to the present day for all sizes from 3 inches to 36 inches in diameter.

No provision is made for running lead or cement into the front of the socket. Either turned-and-bored joints are good, and should be trusted, or if they cannot be depended upon, should be given up. Very accurate gauges for each size of pipe are made by the Gas Company—one being kept as a standard, another used for testing the pipes on delivery, and the third sent to the contractor. Many years ago, I supplied a drawing of this joint to the late Sir George Livesey, who seems to have adopted it.

On p. 595, there is a view of what is there called the "No. 3 S.M.G. Co.'s Standard." It should be named the "Liverpool 1827-1912" pattern, as it is an exact copy of a drawing given by me to the South Metropolitan Company.

In 1901, in conversation with Mr. Charles Carpenter, he stated that he had little or no experience of turned-and-bored pipes; and as a long length of 20-inch main was then being laid in Liverpool, I suggested that he should visit the work and obtain all details as to laying, &c. Mr. Head says that he did so. Also on May 9, 1901, two inspectors of the South Metropolitan Company came to Liverpool, and made a thorough examination (during two days) of the work in progress. The result of these visits was that the South Metropolitan Gas Company adopted the Liverpool methods in such complete detail that Mr. Head's paper as regards testing and laying might be a description of what the inspectors saw on that occasion.

Drawings and gauges were also supplied to the South Metropolitan Company from Liverpool. In 1908, Mr. A. A. Johnston, the Engineer and Manager of the Brentford Gas Company, on my suggestion as a Director, adopted this pattern of joint for a 30-inch main between the Southall and Brentford works, and has from time to time reported that the result is quite satisfactory. Since then he has used this joint for all sizes both for high and low pressures.

WILLIAM KING.

Beach Lawn, Waterloo, near Liverpool,
Nov. 21, 1912.

* This has been reproduced one-third scale.—ED. J.G.L.

Carbonization in Vertical Retorts.

SIR,—The champions of the Dessau system, while waxing enthusiastic over inches of gas pressure within their retorts, have seemingly failed to realize that British invention has supplied, and British enterprise has proved, a system of intermittent vertical retorts which works at less than an inch of gas pressure. "Consistency" says that speaking with full knowledge and experience of Dessau retorts, the coal in charging is not dropped as a fallen body, in consequence of the delivery of coal being guided against the side of the retort.

Since this is precisely the claim of British patent No. 19,437, and is also shown in patent No. 20,851 of the year 1908—*i.e.*, previous to any Dessau retorts being established or contemplated in this country—I ask what consistency there can be in coupling the merits of one system to the name of the other?

For the benefit of your correspondents, I give extracts from the above patents. The patents relate to improvements in charging intermittent vertical retorts, and consist of: (1) A method of charging, consisting in feeding a relatively thin stream of coal adjacent to the side of the retort. (2) A method of automatically adjusting the charge to the capacity of the retort.

H. J. TOOGOOD.

Elland, Nov. 21, 1912.

Benzol for Motors.

SIR,—I am much interested in the letter of Mr. Seymour, of Leeds, upon the above subject. It is most interesting. Will he kindly tell us when and how benzol is obtained from creosote.

X.

Nov. 20, 1912.

In the course of a letter received too late to appear in last week's issue of the "JOURNAL," Mr. G. Stanley Cooper, referring to recent correspondence on the subject of the Koppers chamber ovens at Vienna, says: Owing to an inadvertent transposition of temperatures, the correcting factor which I put forward in the "JOURNAL" for Nov. 12 does not hold good. There is, however, a perfectly straightforward explanation which shows that the discrepancy between the calculated and observed calorific values is more apparent than real. In order to make the explanation complete, it is necessary to refer to a set of figures which, unfortunately, at the time of writing, have not come to hand; but I hope they will be ready for notice in an early issue.

The Runcorn Rural District Council have purchased by private treaty the works erected some years ago by the Manley Estate owners, which supply the parish of Manley and part of the parish of Kingwood with water. The plant, consisting of a pumping-house, a tank reservoir, and eight miles of mains, cost £3000.

PARLIAMENTARY INTELLIGENCE.

NOTICES GIVEN FOR BILLS (SESSION 1913) RELATING TO GAS, ELECTRICITY, AND WATER SUPPLY.

[First List.]

Barry Gas and Water.—The Barry Urban District Council have given notice of their intention to apply for additional powers in respect of their gas and water undertakings. The Bill will define the limits of supply, and make further provisions in connection with the construction and maintenance of works and the manufacture and supply of gas; prescribe the price to be charged for gas supplied through ordinary and prepayment meters; reduce and fix the standard quality of gas, make provision in regard to pressure and testing, and exempt the Council from penalties in certain cases for failure to comply with the enactments relating to them; and empower the Council to increase their reserve fund. With regard to the water undertaking, the Council wish to be empowered to construct new works, comprising a service tank and two aqueducts; supply water in bulk and by measure; define the purposes to be included within the expression "domestic purposes;" and provide that a supply of water furnished for these purposes shall not be otherwise used. More money will be required.

Blyth and Cowpen Gas.—The Blyth and Cowpen Gas Company will apply for authority to extend their limits of supply so as to include the urban district of Bedlingtonshire and the parish of Bedlington, in the county of Northumberland, and to exercise therein all their existing powers. It is proposed to acquire the undertaking of the Bedlington Gas Company, Limited, and pay for it in cash or in shares or stock of the purchasing Company. Power will be sought to manufacture and store gas on lands in Bedlington and Blyth, and also to raise more capital.

Bournemouth Gas and Water.—The Bournemouth Gas and Water Company require authority for the purchase of the undertakings of the Christchurch Gas Company and the Wimborne Minster Water-Works Company, Limited, and for the extension to the enlarged undertaking of the existing provisions relating to either Company. The limits of the Bournemouth Company will be altered so as to include those of the absorbed Companies. The Company also wish to be empowered to maintain and extend the works acquired, purchase the water and gas undertakings of other authorities, alter the existing rates and charges and the illuminating power of the gas, form special and reserve funds, apply their present funds, and increase their capital.

Crowborough Gas.—The Crowborough District Gas Company require authority to purchase land and construct new works, for which additional capital will be needed. It is proposed to substitute a standard price, with a sliding-scale, for the maximum price now authorized to be charged; also to alter the existing provisions relating to the illuminating power and testing of gas, and to prescribe the apparatus and burner therefor. Authority will be sought for erecting a generating station and supplying electricity in the usual way or in bulk; and the Bill to be promoted will contain provisions incidental thereto. The name of the Company is to be changed.

Ebbw Vale Water.—Authority will be sought by the Ebbw Vale Urban District Council for the construction of additional works, comprising two intakes, two aqueducts, and a compensation reservoir, in the counties of Monmouth and Brecknock. The Bill to be promoted will contain general provisions relating to the supply of water, including authority for preserving its purity. Further borrowing powers will be required.

Ely Valley Gas and Electricity.—Authority will be sought for the incorporation of a Company with power to construct and maintain works for the manufacture and supply of gas and electricity within an area comprising certain parishes, townships, and places, all in the county of Glamorgan, to be described in the Bill, which will contain the usual provisions incidental to the business pr posed to be undertaken, including those relating to the quality, pressure, illuminating power and testing of gas. The Company will seek to be enabled, if so agreed between them and any other company having a Provisional Order for supplying electricity in the area to be defined, to accept a transfer of such company's rights, liabilities, and works under the provisions of the Order. The necessary capital and borrowing powers will be required.

Grays and Tilbury Gas.—The Grays and Tilbury Gas Company will apply for an extension of their limits of supply so as to include a number of parishes and places in the county of Essex, and for authority to exercise therein all their existing powers. It is proposed to acquire the undertakings of the Stanford-le-Hope Gas Company, Limited, the Laindon Gas Company, and the Ingatestone and Fryerning Gas Company, Limited, and, in addition, the gas-works at Rayleigh and Billericay. Power will be sought to manufacture and store gas and residual products on lands at Billericay, Rayleigh, Laindon, and Ingatestone; also to apply for Provisional Orders for the supply of electricity, the supply and letting of electrical apparatus, acetylene and other gas plant, &c. Further general powers for the Grays and Tilbury Gas Company will be applied for, as well as permission to raise additional capital.

Harrow and Stanmore Gas.—The Harrow and Stanmore Gas Company will apply for authority to consolidate and convert their existing capital, raise more money, extend the existing and erect new works, and construct two bridges. Provision will be made for establishing a co-partnership scheme, creating a pension fund, and forming special purposes and reserve funds.

Herne Bay Gas and Electricity.—Authority will be sought for the transfer from the Herne Bay Urban District Council to the Herne Bay Gas and Coke Company, Limited, of the powers granted by the Herne Bay Electric Lighting Order, 1909, and for the erection of a generating station and the supply of electricity by the Company. Additional capital will be required.

Leeds Corporation.—An extension of the time specified for the completion of certain works sanctioned in 1901 and 1907 is required by the Leeds Corporation, who also wish to be authorized to construct two conduits. The Harrogate Water-Works Tramroad Act, 1904, the Leeds Corporation (Water-Works) Railway Act, 1904, and an Act of 1907 relating to the making and use of a tramroad and railways to facilitate the construction of water-works, are to be amended. Power to raise more money will be sought.

Llantrisant Gas.—Power will be sought for the dissolution of the Llantrisant Gas Company, and the incorporation of a new Company to take over the concern and supply gas in a defined area, which is to include parts of certain parishes not in the districts of the Garw and Ogmore Gas Company and the Bridgend Gas and Water Company. The capital and borrowing powers of the Company will be defined and regulated; and authority will be asked to raise more money.

Metropolitan Water Board.—Application will be made by the Metropolitan Water Board for authority to construct water-works, a wharf, railways, &c., in the counties of London, Middlesex, Kent, and Surrey. The water-works consist of two service reservoirs at Westerham, and three aqueducts. An extension of time is required for the completion of certain works in Middlesex and Essex; and a revival of powers for the construction of other works in those counties authorized by the East London Water Act, 1900, will be sought. The Bill will contain provisions in regard to borrowing or raising money.

Metropolitan Water Board (Finance, &c.).—Authority will be sought by the Metropolitan Water Board for the repeal or amendment of the Metropolis Water Act, 1902, with regard to contributions to deficiencies in the water fund. It is proposed to alter the basis of apportionment of these deficiencies among the authorities liable to contribute, and to spread the accumulated deficiency over periods of years. Sanction will be applied for to borrow temporarily in order to meet these deficiencies, and to enlarge the powers of the Local Government Board with respect to altering the contribution of the Water Board.

Mid Kent and East Kent District Water.—The Mid Kent Water Company intend to apply for an extension of their limits of supply so as to include certain parishes and places in the rural districts of Elham, East Ashford, Faversham, Hollingbourne, and Bridge, in the county of Kent. It is proposed to alter the water limits of the Canterbury Gas and Water Company so as to exclude Chartham and Upper Hardres. Confirmation will be sought for the existing works and authority for the construction of others, consisting of three pumping-stations, four service reservoirs, and various conduits, adits, and pipe-lines. The Company wish to be empowered to purchase the Ulcomb water undertaking of the Hollingbourne Rural District Council. It is proposed that the Mid and East Kent Companies should be authorized to construct and use the new works and supply water jointly, or that this should be done by the latter Company solely. Provision will be made for agreements between the two Companies named and the South Kent Water Company in regard to mutual supply, and for a reduction of the water-rate in part of the borough of Dover Additional capital and borrowing powers will be required by the Mid and East Kent Companies.

Redcar Gas.—The Redcar, Coatham, Marske, and Saltburn Gas Company intend to apply for authority to enlarge their works, alter the provisions of their Special Acts with regard to the quality, pressure, and testing of gas, and reduce its illuminating power. The Bill will contain provisions as to the appointment, qualification, and remuneration of the Auditor and Secretary, and the granting of pensions to officers and servants. Additional capital will be required.

South Staffordshire Mond Gas (Power and Heating).—Application will be made by the South Staffordshire Mond Gas (Power and Heating) Company for permission to issue part of the authorized capital as preference, and to substitute it for debenture stock. More money will be required. It is proposed to vary and explain the agreement with Mr. Ludwig Mond which was confirmed by the Company's Act of 1901, introduce a co-partnership scheme and establish a benefit fund for the employees, appoint a managing-director, and make provisions in regard to consumers and premises having or using a separate or intermittent supply of gas.

South Staffordshire Water.—The South Staffordshire Water Company wish to be empowered to construct new works, consisting of two wells and pumping-stations, a service reservoir, and three pipe-lines, to be situated in various parishes in the counties of Warwick and Worcester. Authority will be sought for the sale to the Corporation of Birmingham of the Company's undertaking in the parish of Quinton, in the rural district of Halesowen, which is now within the extended area of the Corporation More capital is required.

Swanage Urban District Water.—The Swanage Urban District Council require authority to purchase the water portion of the undertaking of the Swanage Gas and Water Company, and maintain, improve, or discontinue the existing works. The Council wish to have conferred upon them all or some of the powers contained in the Company's Acts of 1901 and the present year, so far as they relate to the water undertaking. Provision will be made in the Bill for entering into contracts for the supply of water in bulk, and for laying mains outside the Council's district. Power to raise more money will be needed.

Tottenham and Edmonton Gas.—The intended application by the Tottenham and Edmonton Gas Company for authority to acquire the undertaking of the Enfield Gas Company, and take over the Provisional Order of the Wood Green Urban District Council for the supply of electricity, is fully noticed elsewhere (p. 691).

United District Gas.—Application will be made for the dissolution of the Counties Gas Company, Limited, and the incorporation of a new Company to acquire the undertaking, including gas-works at Adderbury, Bloxham, Charlbury, Shipton, Bicester, Buckingham, Woodford, and Cricklade in the counties of Oxford, Bucks, Northampton, and Wilts, and manufacture and supply gas and residual products. The limits of supply comprise a large number of parishes in the counties named. Authority will be sought to maintain the existing works and construct others. The Bill will contain provisions in regard to the quality, the pressure, and the testing of gas, its supply to

persons having a separate source of light or power, and the regulation of pipes and fittings. It is proposed to ask for the repeal of the powers of the Banbury Gas Company, within the limits of supply, and for further capital and borrowing powers.

West Hampshire Water.—Doubts having arisen regarding the validity of the creation and issue of certain shares and debenture stock of the West Hampshire Water Company, application will be made for an Act to remove them, and give authority for the proceeding.

Windermere Urban District Council (Gas and Water).—It is the intention of the Windermere Urban District Council to apply for authority to purchase the undertaking of the Windermere District Gas and Water Company, and to supply both commodities within limits specified. The provisions of the Bill to be promoted for the above-named purpose will be of the usual character, and will include power to raise the necessary money.

Worthing Gas.—Application will be made by the Worthing Gas Company for authority to lay down, maintain, and use, under the surface of the road known as Goring Lane, in the parish of Goring, in the rural district of East Preston, in the county of Sussex, a gas main or pipe, or gas mains or pipes, between certain specified points in that lane. The Company wish to have conferred upon them power to use and appropriate, without payment, the subsoil and under-surface of the lane for laying pipes therein, and to "open, interfere with, and alter or add to any tunnel or building constructed under and situate in such road at or between the points named, or any other building, structure, or thing which will or may interfere with the exercise of the powers of the Company under the intended Act or otherwise." The Bill to be promoted will contain provisions as to the compensation to be paid by the Company in respect of any interference with a building such as that just referred to, and also as to their relations with the local authorities having jurisdiction over the lane in question. The Company will seek authority to apply in respect of these authorities and of such works as those indicated, all or any of the provisions of the Gas-Works Clauses Act, 1847, relating to the breaking-up of streets for the purpose of laying pipes; and they will ask for "all such powers as may be requisite or necessary for the purpose of enabling them to connect their existing gas-works in the borough of Worthing with the lands now belonging to the Company in the parish of Goring, in accordance with the provisions of section 7 of the Worthing Gas Act, 1907."

York Corporation.—Authority will be sought by the York Corporation for the purchase of the undertaking of the York United Gas Company, in accordance with the York Gas (Consolidation) Act of the present year, and for the supply of gas within the limits prescribed by that Act, or such others as may be specified. Further powers in regard to the supply of electricity will be required, as well as permission to raise more money.

EAST SURREY WATER ORDER.

Rejection of a Proposed Compensation Clause.

The Water Orders Confirmation Bill [Lords], containing the above-named Order, which, as was mentioned last week, was reported on the 12th inst. by the Select Committee to whom it was referred, came up for consideration by the House of Commons last Thursday.

Mr. HOHLER, the Member for Chatham, moved the insertion of the following new clause at the end of the clause limiting the powers of the promoters [the East Surrey Water Company] to abstract water: "If at any time after the undertakers have enlarged their works or have provided additional or substituted works at their Purley and Kenley pumping-stations or either of them, the supply of water from any existing well or the flow of water in any river or stream shall be diminished, and it shall be proved that such diminution is caused by abstraction of water by the undertakers in excess of the amount which they were able to abstract by means of their works or machinery as existing before the confirmation of this Order, the undertakers shall pay compensation to the owner of such existing well for such diminution, or to the owner or occupier of any land, mill, or works abutting on such river or stream, who may suffer damage by the diminution of the flow of water in such river or stream; and the amount of such compensation shall be ascertained in the manner provided by section 308 of the Public Health Act, 1875." He said the point raised by the new clause was of the greatest importance. The borough of Croydon had spent close upon £500,000 in connection with their water supply. It was obtained from four wells, and also under an arrangement with the Metropolitan Water Board. Of these wells, two were situated in Purley, from which Croydon drew 1¼ million gallons a day; and outside Purley was the rural district of Surrey. The East Surrey Water Company had for some time supplied water in this district. Up till recently, they had two wells not far from those of the Corporation, from the nearest of which they had been in the habit of drawing 1¼ million gallons of water daily; and they had obtained an Order which enabled them to increase the average to 4 million gallons. What was asked was that a clause should be inserted in the Order to protect Croydon and the millowners on the River Wandle for a distance of two or three miles whose supply of water might be interfered with. The Company contended that they could not do any damage to the water for Croydon or to the Wandle. Assuming this was true, he asked the House whether his clause would do any harm. If the Company would neither do Croydon nor the Wandle any damage, why should they not insert in the Order a provision to make compensation if they should do any—the amount to be ascertained by arbitration. He submitted that the clause was a most moderate one.

Mr. W. GUINNESS seconded the amendment. Speaking on behalf of the London County Council, he said they feared the pumping by the Company from a well which was only 280 yards from the Cane Hill Asylum was likely to deplete the well there; and he asked the House to pass the clause. If compensation was payable to the Council, they would be able, by treating with the Company, to get it not in money but in kind.

Mr. F. M'LAREN, in an able maiden speech, submitted, as a member of the Select Committee who had considered the Order, that the House should support the Committee's report and reject the proposed amendment. He said the Order had been referred to three tribunals—the Board of Trade and Select Committees of the two Houses. It was the duty of the House to bear in mind the expert, contentious, and scientific evidence which was at stake; and they should support the Committees who considered the evidence at great length and with much care. Parliament had imposed upon the East Surrey Company a statutory obligation to provide water for an area of 155 square miles, containing a population of 90,000 persons. He claimed that the evidence abundantly showed that there was plenty of water for everybody, and that not only could the Corporation of Croydon be supplied, but also the asylum to which reference had been made. If the House wished to give compensation for underground water, it should bring forward a comprehensive measure to make all companies pumping in this chalk area subject to it. It would be most invidious, if the amendment were carried, that one Company should be liable to pay compensation claims and the others allowed to do any amount of pumping without reparation. If anybody ought to pay compensation, it should be the Corporation of Croydon, for they had three wells which were tapping the springs of the Wandle. These wells were nearer the river than those proposed by the Company; and could anything be more unfair than to ask the House to give the Corporation compensation against the Company when they were denied compensation by the Corporation? He asked the House to reject the clause, as it introduced an entirely new principle into water-works practice.

Mr. HODGE thought the House should have no hesitation in granting the clause, if the statements made by Counsel before the Select Committee were believed in by them.

Colonel BATHURST, as Chairman of the Committee, admitted that their decision was arrived at, after a long inquiry, by his casting vote. But he pointed out that he only exercised the power given to him by the rules of the House. With regard to the special clause relating to the Wandle, he explained that he asked that a clause should be submitted to the Committee purposely to see whether or not it was practicable. Having considered it, and having heard Counsel on both sides, the Committee—he would admit through his casting vote—came to the conclusion that it was not possible to include such a clause, because of the impossibility of proving the liability of the Company. Under these circumstances, he hoped the House would endorse the findings of the Committee.

Sir H. KIMBER, as representing the riparian occupiers and owners on the River Wandle, pointed out that the proposed clause conceded to the Company all the power they asked for in order to take further water. All that it provided was that if in the future the result of their works was to damage the riparian proprietors and mill-owners, contrary to the expectation and assertion of the Company that they would do no damage, then a reference to arbitration should, if necessary, be made to ascertain and to award compensation to the parties interested. He submitted that the proposed clause could do no harm; and he thought it ought to be inserted.

Mr. A. C. MORTON remarked that there were 175,000 people in the area being dealt with, and 130,000 of them obtained their water from the wells mentioned; the rest being supplied by the Metropolitan Water Board. He thought the passing of the clause was the least the House could do for the protection of these people. In his opinion, the weight of evidence submitted to the Committee was in favour of the case presented on behalf of the parties interested in the Wandle.

Lord ROBERT CECIL said the House should in all cases look to see if there was a likelihood of damage being done. If there was, there ought, on principle, to be some kind of compensation clause to prevent those who were making a profit out of water doing so to the injury of other people.

Mr. MOLTENO thought the proposed clause should be granted.

Colonel RAWSON said the hon. member who seconded the amendment had referred to the borehole in the chalk about 280 yards from the asylum. He explained that it was an experimental borehole, and was too small to pump from; nor could the Company draw from it until they obtained further powers. The Company were quite prepared to give an undertaking not to pump from this borehole without the consent of the asylum authorities.

On a division, the amendment was rejected by 88 votes to 66.

Great Boughton Public Lighting.—An order has been received from the Local Government Board conferring urban powers upon the Chester Rural District Council for lighting the parish of Great Boughton. The Council have accordingly decided to apply to the Board for sanction to a loan to defray the cost of the erection of lamps and the supply of gas, as arranged with the Chester Gas Company.

Hayle Gas Company.—Mr. John Vivian presided last Thursday at the annual meeting of the Hayle Gas Company, Limited, and in moving the adoption of the accounts said the figures showed that the past year had been a very satisfactory one. The profit on the working had been £953, against £734 in the preceding year, in spite of the coal strike. Having regard, however, to all the facts before them, the Directors had decided to reduce the price of gas 3d. per 1000 cubic feet, exclusive of contracts, commencing on the 1st ult.; also to recommend a dividend of 5 per cent., free of income-tax, on the paid-up capital of the Company, and the allocation of the balance, amounting to £536, to depreciation. The report was unanimously adopted.

Gas-Main Fire in Kensington.—While a steam motor coal-lorry was passing down Glendower Place, Kensington, last Wednesday night, the left side wheels suddenly subsided into the earth, and broke the gas-main. The escaping gas was ignited by the fire of the lorry's engine, and the flames shot up to a considerable height. For about two hours firemen were battling with the flames; their difficulty being that, owing to the gradual sinking of the lorry over the damaged main, it was impossible to stop the escaping gas. Eventually, however, the two damaged ends of the main were plugged-up by workmen from the Gaslight and Coke Company. The driver of the lorry and his mate sustained slight injuries; but no inconvenience was caused to the consumers.

LEGAL INTELLIGENCE.

RATING OF LICENSED PREMISES FOR WATER SUPPLY.

HOUSE OF LORDS.—Nov. 18.

(*Before the* LORD CHANCELLOR *and Lords* ATKINSON, SHAW, *and* MERSEY.)

Their Lordships to-day gave their decision in the case of the Metropolitan Water Board (appellants) *v.* Phillips (respondent), arguments in which were heard on Nov. 4 and 5, and were reported in the "JOURNAL" for Nov. 12, p. 524.

The LORD CHANCELLOR said the question before the House was, "What was the rateable value on which the water-rate of the respondent's premises ought to have been calculated for the quarter from Oct. 1 to Dec. 31, 1910." Under the combined operation of the Water-Works Clauses Act, 1847, and the Metropolitan Water Board Charges Act, 1907, the water-rate was payable in advance by equal quarterly payments, and a payment became due on Oct. 1, 1910. By section 13 (1) of the second of these Statutes, it was provided that the rateable value of a house or building was, for the purposes of the Statute, to be determined by the valuation list in force at the commencement of the quarter for which the water-rate accrued, or, if there was no such list in force, by the last rate made for the relief of the poor. The appeal therefore turned on a single point, What was the rateable value, as stated in the valuation list, in force on Oct. 1, 1910? In the year 1908, the valuation list then in force in the parish of the City of London was altered in accordance with the provisions of the Valuation (Metropolis) Act, 1869, by the making of a supplemental valuation list, in which the rateable value of the "Brown Bear" was shown as £400; and this list came into force on April 6, 1909. On June 2, 1910, the Overseers of the parish sent to the Assessment Committee, in accordance with the provisions of section 47 of the Act of 1869, a provisional list in which the "Brown Bear" was included at the reduced rateable value of £399. On June 23, the Clerk of the Assessment Committee served on Mr. Phillips, as occupier, a copy of so much of the list as related to his premises, along with a notice specifying the time within which objection might be taken. In the result, the Assessment Committee considered the provisional list, and on Oct. 3 reduced the rateable value from £399 to £234; thereafter returning the list and a copy of it dated on that day and signed by their Clerk in accordance with the provisions of section 47. On these facts, his Lordship came to the conclusion that the amount shown in the valuation list in force Oct. 1—the crucial date under section 13 of the Charges Act, 1907—was £400, as contended by the appellants, and not £234 as contended for by the respondent. In the Court of Appeal, the argument mainly turned on the construction of the Act of 1869. Under its provisions, the valuation list might answer any one of these forms. It might be the original list as approved by the Assessment Committee. And, if so, it lasted for five years unless altered by a supplemental or provisional list. So long as it was in force, it was conclusive as to the gross and rateable value, and determined the value not only for the purposes of certain specific rates and taxes, but for the purposes of the Acts relating to the qualification of jurors and vestrymen. By the second, it was provided that in each of the first four years of the quinquennial period a supplemental list was, if necessary, to be made out in form and fashion similar to the original list, showing, in the case of hereditaments affected by alterations of the matter specified in that list, any change in the valuations; and this supplemental list was to come into force at the beginning of the year in which it was made. The third form of list was that provided by section 47, and was sanctioned to meet the case of a change in value taking place within the year. The cardinal fact appeared to his Lordship to be that, after the passing of the Act of 1869, the Legislature, by the passing of the Charges Act, 1907, laid down a new and simple rule for the ascertainment of the rateable value on which the water-rate due in advance at the commencement of such quarter was to be paid—it was to be on the valuation list in force at the commencement of that quarter. The provisional list was not signed until after the commencement of the quarter (Oct. 1 to Dec. 31), for it was not signed until Oct. 3. Unless, therefore, there was some clearly expressed intention of the Legislature to take back at a subsequent date the right which had accrued to the Water Board on Oct. 1, this right must prevail. For these reasons, he was of opinion the appeal should be allowed.

Lord ATKINSON read a long judgment to the same effect. He said the question was, What was, in the circumstances of this case, the valuation list which answered the description of "the valuation list in force" on Oct. 1, 1910 (the quarter day upon which the water charge sued for became due), within the meaning of section 13 (1) of the Act of 1907? The plain language of that section answered the question. It was to be the valuation list in force at the commencement of the quarter; and if no such list was then in force, the rateable value on which the charge was to be based was to be determined by the last-made rate for the relief of the poor or other rate in which such last-made rate was included. There was no statement in the case as to what the latter rate was. To answer the question it was necessary to consider section 43 and four following sections of the Valuation (Metropolis) Act, 1869, and to construe the confused, obscure, and ill-drafted provisions of some of the sub-sections of the last of these sections—namely, section 47. Having considered these sections and sub-sections in detail, it seemed to him important to remember that the occupier was not to be served with a copy of the provisional list, but only with a copy of the item in it which concerned his own hereditament. The occupier would within 14 days object; and then machinery was provided for bringing his objection before the Committee. In the present case, the list proposed by the overseers differed widely in reference to the "Brown Bear" from that dated and signed by their Clerk. In the former, which was sent to the Assessment Committee on June 2, 1910, the rateable value of the "Brown Bear" appeared at £399. In that dated and signed by the Clerk of the Assessment Committee on Oct. 3, the rateable value was fixed at £234. It seemed to him, for the reasons given by Mr. Justice Parker and approved by the Master of the Rolls in his dissenting judgment, that the assessment fixed in the list signed and dated Oct. 3 did not relate back to Oct. 1. Accordingly, he thought that the judgment of Mr. Justice Parker was right and should be affirmed, and the appeal allowed, with costs.

Lord SHAW concurred in the appeal being allowed. He thought that the reasons for adopting this course were ably put forward in the judgment of the Master of the Rolls.

Lord MERSEY also concurred. Having had the advantage of reading beforehand the judgment of the Lord Chancellor, with which he entirely agreed, he only desired to give his reasons very shortly.

On the motion of the Lord CHANCELLOR, the appeal of the Water Board was allowed, with costs, and the judgment of Mr. Justice Parker was restored.

DISPUTED CHARGE FOR WATER AT NUNEATON.

In the King's Bench Division of the High Court of Justice last Thursday, Mr. Justice BAILHACHE gave judgment in an action brought by Stanley Bros., Limited, colliery owners and brick and tile manufacturers, of Stockinford, against the Nuneaton Corporation, to determine the price at which they could claim a supply of water.

Mr. JOY appeared for the claimants; Mr. HUGO YOUNG, K.C., represented the Corporation.

At the close of the arguments,

His LORDSHIP gave judgment. He said it had been contended for the claimants that under a conveyance dated Jan. 17, 1900, they were entitled to a supply of water from the Corporation, when their own available sources were not sufficient, at 2d. per 1000 gallons. The Corporation, on the other hand, said the claimants were not entitled to the supply, at any rate in the way in which they desired to get it, and that if they had it through the ordinary channels they must pay at the rate of 8d. per 1000 gallons. For nearly ten years the claimants had paid this rate for all the water they had had from the Corporation; but they now said that they had done so in ignorance of their rights, and that they were entitled to a return of the difference between the two amounts. They also asked for a declaration as to what their rights were under the conveyance. The dispute went to arbitration, and the Arbitrator had, in substance, found in favour of the Corporation. He had stated his award in the form of a special case with several alternatives; and the question for the Court was whether the award was right, and, if not, which of the alternatives submitted ought to be adopted. The facts were as follows: The claimants found themselves considerably embarrassed by large quantities of water which they wanted to get rid of. The Corporation had a supply which was not quite so adequate as they wished; and they were willing to take water from the claimants. In these circumstances, a supply agreement was entered into, under which, on certain terms, the claimants supplied water to a reservoir of the respondents. The agreement was dated Dec. 15, 1897, and was in force about a year and three-quarters. On Oct. 4, 1899, a "sale" agreement was come to, under which the Corporation agreed to take over certain property of the claimants, and were to supply them with the water they might require. This agreement was followed by the conveyance already referred to; and the main question in the case turned on what was the true construction of one of the covenants, which was in these terms:

> And the Council hereby covenants with the Company that they (the Council) will, in the event of the Company being unable to obtain sufficient water for the purpose of the works of the Company from all their available sources, supply the Company with water at cost price, not exceeding 2d. per 1000 gallons: Provided nevertheless that the Council will only be liable to supply the Company with a proportionate quantity of such water as for the time being is available for manufacturing purposes, or supplied by meter, or otherwise, after the domestic supply has been provided for; so that, if the available water supply is deficient, manufacturers and others supplied by meter shall share rateably with the Company.

Before dealing with the main question, there were two points of law submitted to him by the Arbitrator. The first was that, granting that the claimants were in ignorance of their rights under the conveyance, it was a case of ignorance of law and not of fact; and that while they might, notwithstanding this, be entitled to the declaration they asked for if he agreed with them as to the construction of the covenant, they were not entitled to the return of any moneys they might have overpaid to the Corporation on the ground that ignorance of the law was no excuse. The respondents claimed that the Statute of Limitations applied; and in this he thought that they were clearly right. He now came to the main question of what was the true intent and meaning of the covenant in the conveyance. Mr. Young pressed upon him that, in considering the covenant, regard must be had to the history of the case and to the surrounding circumstances. He urged that the water was now costing the respondents something like 8d. per 1000 gallons, and that it would be absurd to suppose they had entered into a permanent engagement to supply it at 2d. He (his Lordship) agreed that, to some extent, he ought to take into account the surrounding circumstances when he construed the covenant. The first thing was the supply agreement of Dec. 15, 1897. He did not attach much importance to this; but he referred to it because Mr. Young called attention to the prices at which water was to be supplied, and said he must draw from this and from the "sale" agreement the conclusion that the figure was arrived at by treating the cost price of pumping at 2d. per 1000 gallons and the remainder was the price of the actual water. Mr. Young based upon this the argument that when he found in the conveyance the cost price fixed at 2d., he must read that it would mean merely the price for pumping. He argued that the conveyance really referred to the pumping of water to the claimants' reservoir, and negatived the idea that they were to get water from the general sources of supply in the mains of the Corporation. Bearing all the previous facts in mind, he (his Lordship) came to the construction of the covenant. There had been no action or application to rectify it; and a great deal of Mr. Young's argument would

have been more cogent to an application for rectification. If there had been such an application, the fact that the claimants did not seek to enforce the covenant in the way they now sought, but were content for nearly ten years to pay 8d. instead of 2d. per 1000 gallons, would have been a very cogent factor in the case. He could not take this dilatoriness into account, and press it against claimants, for the reason that the Arbitrator had found as a fact that they did what they did in ignorance; and by this finding of fact he (his Lordship) was bound. The proviso seemed to fortify him in the view he came to as to the construction. Some of the water which claimants had from the available sources was not fit for all their purposes, on account of its impurity; and it seemed to him that, to the extent to which the water was not available for this reason, there was a deficiency. Upon the whole, therefore, he came to the conclusion that the claimants were right. He would point out, however, that there was not the slightest ground for suggesting that there was any warranty by the Corporation that the water they were able to supply from their ordinary sources would be fit and proper for the claimants' purposes. He desired to be very emphatic on this point. It remained to consider the result of his judgment upon the scheme of highly complicated alternatives submitted to him by the Arbitrator; and he made a declaration that the claimants were entitled to require the respondents to supply them with water at a cost price not exceeding 2d. per 1000 gallons. With regard to the money, the Arbitrator had reduced the claim from £2314 to £1718 by disallowing certain items; and he upheld the Arbitrator in this respect. Then he must reduce the figure still further by reason of the Statute of Limitations; and he made the amount to which plaintiffs were entitled £1426.

Stay of execution on terms, in view of an appeal, was granted.

Dispute as to Payment for Water by Meter.

A dispute of much interest, though the amount involved was small, came before his Honour Judge Harris Lea, at the Leominster County Court, on Monday last week. The plaintiffs were the Corporation of Leominster, and the defendant was Mr. C. E. A. Moore, who is the Clerk to the County and Borough Magistrates and Coroner for the district. The claim was for £1 6s. 2d.; being the amount of the water-rate for two quarters, calculated on the basis of the rateable value of the premises. Mr. Moore disputed the amount, contending that under an agreement with the Council he was entitled to pay according to the meter charge, which was 15s. This amount he had paid into Court. It appeared that in 1910 the Corporation decided that payment for water should be made on the basis of rateable value; and it was contended, on Mr. Moore's behalf, that he had not had proper notice of the change. A letter was sent to him on Jan. 16, 1912, that his meter would be removed next day; but this was held by his Honour not to have been a proper notice to determine the agreement. He thought three months' notice, given before Dec. 31, would have been reasonable. He therefore gave judgment for the defendant.

MISCELLANEOUS NEWS.

TOTTENHAM AND ENFIELD GAS COMPANIES.

Projected Amalgamation—Electric Lighting Powers for the New Company.

The Tottenham and Edmonton Gas Company have given notice of their intention to apply to Parliament next session for authority to acquire the undertaking of the Enfield Gas Company, and for the transfer to them of the Electric Lighting Order of the Wood Green Urban District Council. The following is an epitome of the Bill.

The undertaking of the Enfield Gas Company is to be transferred to the Tottenham Company, subject to such terms and conditions as may be or may have been agreed upon, or as may be prescribed by the Bill. Provision will be made for the carrying on of the undertaking of the Enfield Company between the date of the passing of the intended Act and that of the transfer; and such restrictions and limitations as may be deemed fit will be imposed upon the powers of the Company in the district during this period. The limits of supply of the Tottenham Company are to be extended by the addition of the area of the Enfield Company, and the purchasing Company are to be enabled to open streets and roads, supply gas, and exercise and enjoy all the rights, powers, and privileges usually appertaining to gas companies. Provision will be made in regard to the price to be charged for gas in the extended area, and for establishing differential rates. It is proposed to reduce the illuminating power of the gas, and alter the prescribed apparatus and burner for testing, within the limits of the Enfield Company. The officers and servants of that Company are to be transferred or compensated; and the Directors and Auditors will receive payment in consideration of loss of office. The Tottenham Company wish to be empowered to commute or compound any existing pensions of the Enfield Company, which will, of course, be dissolved and wound up.

It is proposed to ask for the repeal of so much of the Barnet District Gas and Water Act, 1872, and of the Colney Hatch Gas Company's Act, 1866, and any Act amending or extending them, as authorizes the Barnet Company and the Southgate Gas Company (as successors of the Colney Hatch Gas Company), or either of them, to supply gas within any portion of the existing limits of supply of the Enfield Company, and to provide that the powers and obligations of these Companies, or either of them, in regard to the supply of gas within the existing limits of that Company shall cease and determine, or for the making of such other provisions with reference to these matters as may be authorized or provided for by or under the intended Act.

The Tottenham Company will ask for authority for the Wood Green Urban District Council to transfer, assign, lease, or otherwise convey the undertaking authorized by the Wood Green Electric Lighting Order, 1902, or all or some of the powers granted thereby, to the Company, and to authorize them to exercise all the powers of the Council in respect of the undertaking. The Bill will contain provisions to confirm and sanction any agreement which has been or may be entered into prior to the passing of the intended Act between the Council and the Company with reference to the transfer of the Order; to amend section 6 of the Order by extending the period within which the Council are required to lay down distributing mains in the streets or parts of streets named; to empower the Company and any local authority, company, body, or person who may have been or may be authorized to supply electricity either within or beyond the limits of supply of gas for the time being of the Company, to enter into and carry into effect agreements for the transfer to the Company of the undertaking, powers, rights, privileges, liabilities, and obligations of such local authority, company, body, or person or any other part thereof; and to authorize the Company and any local authority, company, or person who may have obtained or may obtain a Provisional Order or Special Act for the supply of electricity to enter into and carry into effect agreements for the execution and maintenance of any works needed for the purpose of such supply, or for the supply of electricity within any area mentioned in such Order or Act or any part thereof.

The other provisions of the Bill relate to the supply of gas to persons having a separate service, the regulation of gas pipes and fittings, the supply and removal of apparatus, the fixing of the Secretary's remuneration by the Directors, the formation of a special purposes fund, the application of funds, and the increase of capital and borrowing powers. The name of the Company is to be changed to that of the Tottenham and District Light, Heat, and Power Company, or such other as may be defined in the Bill.

PROJECTING ILLUMINATED SIGNS AND LAMPS.

The Brighton Appeal.

Some discussion took place in the Brighton Town Council last Thursday with regard to the recent appeal to the Recorder against the action of the Corporation in removing certain lamps outside business premises, on which the name of a firm appeared [*ante*, pp. 301, 451]. The judgment was against the Corporation, who asked the Recorder to state a case.

The adoption of the proceedings of the Improvement Committee having been proposed, Mr. Skinner moved the exception of the paragraph relating to a proposed appeal from the decision of the Recorder in the case of Clark's Bread Company and the Corporation. He said the Corporation should hesitate before they took the matter any further, if he were correct in his view as to the points on which a case was to be stated. He thought it was asserted at the hearing that the Corporation had the right to give a final judgment as to whether or not any particular sign projecting into the street was objectionable. They claimed that there was no right of appeal against their decision to any Court; and he thought this was the particular point on which the special case was being stated, and upon which the decision of a higher Court was desired. If this were so, he hoped the Corporation would think before they adopted the suggestion made by the Committee. It was undesirable that the Corporation should have such extensive powers, and that no opportunity should be given to people whom these powers affected of appealing against the Corporation's decision. It seemed that if the Corporation claimed this arbitrary power, it would be like taking the position of prosecutor and judge in one. It was a power the Corporation should not seek to obtain.

The exception having been seconded, Mr. Parry said it was very unpopular for the Corporation to fight local tradesmen in a case like this. The Town Clerk mentioned that the order had been in force since 1825, and had been acted upon at various times since 1831. He recollected that for nearly 25 years past the same action had been taken on occasions in order to get rid of this nuisance of projecting signs—a nuisance which grew, and grew, and grew. If the judgment stood, the power of the Corporation to deal with these signs would for all intents and purposes be gone. It was not only this lamp, but the whole question of projecting signs; and the effect of the judgment was that there was no nuisance unless the projection caused an actual physical obstruction.

The exception was lost, and the proceedings of the Committee were adopted.

REGENERATOR SETTINGS FOR MARYPORT GAS-WORKS.

At their meeting on Monday last week, the Maryport Urban District Council decided to adopt at their gas-works the regenerator system of setting retorts. In March last, a proposal to this effect was put forward by the Chairman of the Gas Committee (Mr. T. Hardy) and rejected; the majority of the Council wishing that the question of the advisability of taking the supply of coke-oven gas from the Flimly Colliery Company's bye-product ovens (a mile out of town) should be inquired into. A deputation was appointed to visit several places where this gas is used for supplying urban communities; but the report was unfavourable. It is proposed to put in three beds of regenerator retorts, two of eight and one of six. These will have a productive capacity of 220,000 cubic feet per day, while two beds of six direct-fired retorts, which it is proposed to retain for the present, as they have just been reset, will permit of another 60,000 cubic feet being made if the necessity arose. In supporting his motion for the adoption of the system, Mr. Hardy put the saving, as compared with the direct-fire principle, at 4 cwt. of coke per ton of coal, which would mean £400 or £500 saved in a year. Then they expected to get 1000 cubic feet more gas out of every ton of coal; and the additional profits might be put at a minimum at something like £700. The cost, estimated at about £1500, would be met by taking the £600 they would then have in the reserve fund and the remainder out of two years' revenue. The motion was agreed to.

CHURCH STRETTON WATER ARBITRATION.

First Day's Proceedings.

Arbitration proceedings, in accordance with the provisions of the Lands Clauses Act, in respect of the purchase of lands otherwise than by agreement, were commenced last Tuesday week, and continued on subsequent days, at the Surveyors' Institution, Great George Street, to determine the price to be paid by the Church Stretton Urban District Council for the undertaking of the Church Stretton Water Company, Limited. Mr. A. J. RAM, K.C., officiated as Arbitrator.

Mr. BALFOUR BROWNE, K.C., and Mr. CROSSMAN (instructed by Messrs. Oliver Richards and Parker) appeared for the Company; Mr. ALEXANDER WEDDERBURN, K.C., and Mr. A. GRAHAM (instructed by Messrs. Baker and Sons) represented the Council.

THE CASE FOR THE COMPANY.

Mr. BALFOUR BROWNE, in opening the case for the Company, said the parish of Church Stretton was a very large one, covering 10,285 acres. The town was 12 miles from Shrewsbury; and in 1891 the population was only 1700. The people were mainly in three villages—Church Stretton, Little Stretton, and All Stretton. On the west of these villages were very high hills, rising to 1700 feet above sea-level; and on the east there were also hills. Between 1893 and 1896, Church Stretton, which was the principal village or town, was practically stagnant; but owing to its high position, bracing air, and excellent water, many people thought it was capable of becoming a health resort. In 1897, the water supply was taken from the Town Brook Hollow; and there was a reservoir of a capacity of 143,000 gallons. Little Stretton was supplied from another source; All Stretton also had a local source. In 1897, the Church Stretton Land Company was formed, and set about doing what they could to develop the town. This Company were the promoters of the Water Company, as well as two hotel companies, and an electricity supply. To deal with the water supply, they promoted a Bill, which became the Church Stretton Water Act of 1899. The capital was to be £20,000, in 2000 shares of £10 each, with the usual borrowing powers. Various works were authorized; and the Company were empowered to impound certain waters—with provisions for compensation water. The Company purchased under their Act the existing Church Stretton Water-Works Company, Limited, and the Little Stretton Water-Works Company, Limited. One section stated that if, within ten years after the expiration of twelve months from the time when the Company commenced to supply water by means of the works to be constructed under the Act, the Council desired to acquire the new undertaking, the Company should not oppose a Bill promoted for the purpose, except for the insertion of clauses to protect their interests. It was stipulated that, failing agreement, the price should be determined by arbitration in accordance with the provisions of the Lands Clauses Act. A reservoir was constructed to contain 10 million gallons; and this had been sufficient for the requirements of the town up to the present time, with the assistance of the Town Brook Hollow and an intake on the Carding Mill Stream. All the water was supplied by gravitation. By 1911, the population of the parish had increased to 2435. Negotiations for the purchase of the undertaking took place in 1910 between the Local Authority and the Company, who offered to sell for £26,000. The ratepayers held a meeting; and in consequence of a resolution passed thereat the Council promoted the Bill of 1912, which was passed, and gave them power to purchase. The Council were to pay the Company the costs of obtaining the Act of 1899; the taxed costs and expenses incurred by them in obtaining clauses and amendments for their protection in the Act of 1912; the taxed costs of, and incidental to, any arbitration, and the transfer of the undertaking, and the winding-up of the Company; and the actual amount expended by the Company with the consent of the Council in pursuance of the Act of 1912. The value of the undertaking had to be ascertained in the ordinary way, by finding out the maintainable income, and how it was secured. The accountants had met, and had practically agreed the figures, on which there would be very little dispute. Taking the latest available figures, and making the necessary adjustments, the Company said the net maintainable income from the works was £729. If this was the right figure, the question was how it was secured; and the Company said it was well secured. There was good water, and a steady, though not continuous, increase in business, which would certainly be maintained in the future, having regard to the large amount of money being spent both by the Local Authority and the Land Company. They put the figure named at 26 years' purchase, which brought out £18,954. But they had to look into the future, and see, first, their limitations, and, secondly, the probable growth of the population in the district. The limitation was that, at the present rate of growth, they had only sufficient water to carry them on until 1923, when they believed the population would be 3062. The population now, with the net revenue of £729, was 1847. This, of course, was eliminating All Stretton, which had a Company of its own. They claimed that in 1913 the population would be 1934, which would give a net revenue of £750 18s. 8d., or an annual increment of £21·87. The capital value of this increment of £21·87, on the 26 years' purchase table, was £568·62; and the present value of this (it had to be discounted, as it was not yet in hand, and would not be for a year) was arrived at by multiplying the £568·62 by 0·9629, which gave £547 3s. 2d. Exactly the same thing had been done for every year down to 1923—of course, discounting by a larger amount every year as it came on. These increments, added to the £18,954, gave £24,737 10s. 7d., to which he added 10 per cent. for compulsory sale, making £27,211 5s. 8d. He did not know that there were any defects in the concern. The water was excellent; and the works, he thought, were fairly up to date.

Mr. *William Cash*, examined by Mr. BRLFOUR BKOWNE, said he had gone over the books of the Company, and had agreed certain tables with Mr. Keen. The capital under the 1899 Act was fixed at £20,000, with a maximum dividend of 10 per cent., and borrowing powers of £4250. The share capital issued was £17,000, and all the loan. The transfers of shares that had taken place had been for the most part at par. The total length of mains laid prior to 1901 was 3296 yards; and since that date, 13,468 yards. After the year named, nothing less than 3-inch pipes had been put down. Since 1907, the Company had paid 3¼ per cent. dividends, which amounted to £552 10s. gross per annum. The Company had had a loan from their bankers for a number of years. He was told there were no private water supplies in Church Stretton. The charge for domestic supplies was 7 per cent., subject to reduction in certain cases. The extras were 5s. a year for a second water-closet, and 7s. 6d. for each bath. For supplies of water by meter, the charge was not to exceed 1s. 6d. per 1000 gallons. The Electric Light Company and the National Schools were supplied at 1s.; while the charge for public purposes and to the railway companies was only 3½d. per 1000 gallons. Witness explained the items in the agreed tables.

Cross-examined by Mr. WEDDERBURN, witness said the transfers showed that some shares were sold at £8 and £9 each. A commission was also paid for placing shares. Of course, one would always draw a distinction between a large company, with readily marketable shares, and a small company whose shares, by reason of the nature of the undertaking, were not marketable. One would always expect the latter to yield a higher rate of interest. It did not, however, necessarily follow that, in assessing the value of such a company, one would always take a smaller factor for the number of years' purchase. In connection with little companies, there were cases to be found in which local people would give extraordinary prices for shares, as compared with the London market. The tables showed that the gross water-rental and the balance carried to net revenue account had for the last three years been practically stationary. It was true that, in order to pay the 3¼ per cent. dividend, the administration of the Company had had to be conducted on the cheapest possible lines. The Directors of the Company had received no fees, though they had been paid certain sums as travelling expenses. For several years the Electric Light Company owed money for their water supply. He inquired about this, and was assured that the Company were perfectly well able to pay, but that they were working with a small capital, and the amount had been allowed to stand over.

Mr. *Edward Bond*, examined by Mr. BALFOUR BROWNE, said he had been for many years (though he was not at present) Member of Parliament for East Nottingham, and in 1900 was elected Chairman of the Church Stretton Land Company. He was at present Chairman of the Church Stretton Developments, Limited, who purchased the assets of the Land Company. He had been Chairman of the Water Company since 1900. Church Stretton was, in his view, admirably adapted for development as a health resort. In fact, since the advent of the Land Company it had largely developed. The influx of visitors in the summer months had much increased. There had been a growth of 78·3 per cent. in the population in the urban district between 1901 and 1911. Asked as to some of the transfers, he said they referred to compulsory sales. The money was wanted for other purposes, and the shares were sold at the best price that could be got for them.

In cross-examination by Mr. WEDDERBURN, witness said the Land Company had not been such a success as they anticipated it would be. It started very well.

Mr. BALFOUR BROWNE (in re-examination): The Land Company may or may not be prosperous; but has that anything to do with the question of the Water Company?

Witness: No.

Mr. *W. B. Keen*, whose evidence on behalf of the Council was interposed at this stage, said, in answer to Mr. GRAHAM, that he had, in conjunction with Mr. Cash, got out the accounts which had been referred to. The amount of capital unspent was £264. As to the commission paid for placing shares, this was sometimes 1½ per cent., and in other instances 2½ per cent. The total amount of commission so paid was £110. Looking at the accounts generally, he did not find anywhere any deduction at all in respect of renewals of plant or machinery. The actual expenditure for repairs amounted in 1911 to only 14s. This was on reservoirs alone; there was nothing spent on mains and services. The conclusion he drew from this was that there must have been an insufficient expenditure incurred to meet the actual wear and tear taking place, and that therefore some adjustment of the account was necessary. If this were so, there would be a sort of accruing charge running up against the undertaking in future years in respect of these matters. During the last three years, the water revenue had been practically stationary. The administration expenses were very light, presumably because the Company was one of a group working together. As a matter of fact, the balance of the revenue account had been decreasing in the last three years—from £741 in 1909 to £701 in 1911. The dividend last year was not quite earned; the amount being £9 short. There was no evidence in the books of the Company of anything being set aside for a reserve or renewal fund. A renewal fund was essential, in view of the trifling expenditure on repairs; and a reserve fund also was necessary for the stability of a company, if it was treated as of the first class. The Company had borrowed money from the bank and had lent money to the Land Company—receiving a higher interest than they paid. The effect would be that £10 or more of the revenue was in respect of a matter quite outside the sphere of a water company—and, speaking as an auditor, he should have said quite outside the legal powers of the Company. For purposes of capitalizing the income, this should be entirely excluded. Altogether the financial position of the Company was not satisfactory. Substantial water companies quoted on the Stock Exchange paid, as a rule, something between 4½ and 5 per cent. to the investor. In the present case, he thought a smaller number of years' purchase should be taken than that which had been named by Mr. Balfour Browne.

Cross-examined by Mr. BALFOUR BROWNE: He was not aware that any profit on the loan to which he had referred had not been capitalized by the Company. In his view, a statutory company could without any express powers provide through a renewal fund for wear and tear. He was aware that almost every gas company who had recently applied to Parliament had got express powers to create these funds; but probably this was with a view to fixing the amount to which the funds might go. It was the duty of a company to repair and renew out of revenue; but it would be unfair in the early days of a company, before its plant and machinery were worn out to the extent that they required renewing, to treat the whole revenue of those years as maintainable

profit, because obviously it must be reduced by the amount of wear that took place and would be repaired later. The wear and tear of a reservoir, he admitted, was not very great.

In re-examination by Mr. WEDDERBURN, witness stated that supposing the Land Development Company went bankrupt like the Land Company, it would at once put up the expenses of the Water Company; they could not get their business managed at the present price.

The case for the Company was then resumed, and

Dr. *Samuel Rideal* was called. Replying to Mr. BALFOUR BROWNE, he said he had inspected the New Pool Hollow reservoir, which was supplied by the upper waters of the Carding Mill Stream. The gathering ground was a very good one – quite moorland. No filtration had been adopted, and he did not think it was necessary. From the chemical analyses he had made, the water would be regarded as a first-class drinking water. He had also made a bacteriological test, and the number of organisms present was quite low. In fact, looking at both analyses, he certainly should not filter the water. The *coli* organisms that he found were not of human organism. He had also examined the water at Town Brook Hollow, and found it very similar to the other. No filtration at all was required here, though an old filter was in position. The water had some action on iron; but it was not injuring the mains.

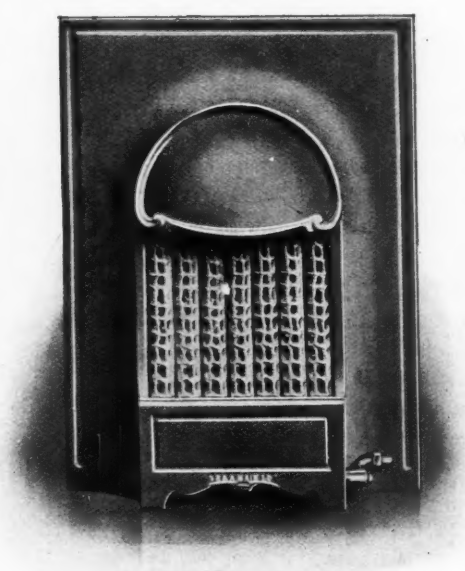
Mr. WEDDERBURN, in cross-examination, produced a bottle of water containing fresh-water shrimps, and labelled, "Collected from a hydrant on old mains in High Street, near the south-west corner of the graveyard." Witness said these organisms were perfectly harmless, and had no doubt been growing in the hydrant. It was a dead-end, and no one could tell how long they had been living there—it might have been a year. These shrimps going into a hydrant would not be kept out by any method of filtration.

Mr. *William Sherratt*, in answer to Mr. CROSSMAN, stated that he was an estate agent, and previously lived at Church Stretton. Formerly he was an inspector and collector for the Water Company. Properly managed and looked after, Church Stretton ought to become a very popular place. Practically the unanimous opinion was that the water was excellent; there had been very few complaints.

Cross-examined by Mr. WEDDERBURN: There was a footpath near the Town Brook Hollow reservoir, which trippers sometimes used; and they also went near the New Pool Reservoir.

Second Day.

Mr. *E. Brough Taylor*, examined by Mr. BALFOUR BROWNE, said he had for many years been acquainted with the neighbourhood of Church Stretton. In 1898, his firm (Messrs. John Taylor, Sons, and Santo Crimp) were appointed by the Land Company to investigate the question of obtaining a water supply for the building sites which they had then in the market; some of the sites being at too high an elevation to obtain water from the then existing sources. Ultimately his firm recommended the Land Company to go to Parliament for the purpose of obtaining powers to purchase the undertakings of the existing Companies, and to sanction the carrying out of a new scheme of water supply. The result was the Act of 1899, under which the limits of supply were defined as the ecclesiastical parish of Church Stretton. There were no powers in the Act to enable them to purchase the undertaking supplying All Stretton. The population of the area of supply in 1891 was 1112; and ten years later it was practically the same. By 1911, however, it had grown to 1764. Over the decade, this increase amounted to 58 per cent., or at the rate of 4·7 per cent. per annum compound. If this rate of growth continued, the population in 1914 would be about 2000; in 1919, 2500; and in 1923, about 3000. The basis of the scheme contemplated when the Company went to Parliament was the supply of 5000 people; but the scheme as actually carried out by his firm was much smaller, and would only supply, at the present rate of increase, up to 1923. The sources originally proposed were tapped; but they did not impound so much water. The average rainfall over the collecting area was between 36 and 37 inches; and of this he calculated 14 inches were available. Taking the capacity of the New Pool Hollow reservoir at 10,000,000 gallons, and reckoning 140 days' storage, this gave a supply of 71,400 gallons daily. There was a further unimpounded area above the reservoir which would yield an additional minimum quantity of 7100 gallons, making a total daily supply from the New Pool Hollow Valley of 78,500 gallons. From the Light Spout Stream he calculated the minimum flow to be 31,200 gallons, giving 109,700 gallons from the two sources. For compensation purposes, the Act required them to pass into the Carding Mill Stream a quantity of 62,500 gallons a day. The minimum flow of the stream down to the mill in Carding Mill Valley was about 18,000 gallons a day, so that 44,500 gallons daily during the period of dry weather must be taken from the compensation reservoir. This would leave them for their supply a quantity of 65,200 gallons a day. Then by purchasing the old undertakings, the Company became possessed of the Town Hollow reservoir; and the minimum flow of the stream running into this he had calculated at 13,500 gallons, which gave a total available daily supply of 78,700 gallons in a period of minimum rainfall. At other times of the year, of course, there would be a very much larger volume of water. Allowing 25 gallons per head per day, the 78,700 gallons would be sufficient for a population of 3150; but he had taken credit for a supply to 3062 persons. Owing to the geological formation, there was a certain amount of leakage in connection with the New Pool Hollow reservoir; but the water so escaping flowed into the stream and went towards compensation. In his view, this matter was in no way detrimental to the permanent structure of the reservoir. The gathering ground was absolutely free from any habitation; and there was very little peat. It was the most excellent gathering ground one could mention. As the transfer would take place near the end of the present year, and the balance-sheets only went up to 1911 in the agreed tables, he had, for the purpose of arriving at the value of the undertaking, estimated a balance-sheet for 1912, basing it upon the information obtainable from the five preceding years. He brought out a total expenditure of £214 4s. 7d., and an income of £930 16s. 7d.; the net balance upon



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revenue account being thus £716 12s. This was dealing with the average figures. He found, however, that in 1912 there had been certain increases in domestic and building supplies, which ought to be reckoned with; and he had produced figures on this basis which showed a net balance of £729 0s. 2d., instead of the £716 12s. previously estimated. Multiplying the £716 12s. by 26 years' purchase gave £18,631; and treating the £729 0s. 2d. in the same way, they arrived at £18,954 4s. 4d. The multiplier named he regarded as a fair one in this case. Assuming a yearly increase at the rate of 3 per cent., and capitalizing this on the 26 years' basis, reduced back to present value, this would give a prospective value of £5783, which, added to the £18,954, gave a total of £24,737. To this was added 10 per cent. for compulsory sale of the works, making the total valuation £27,211 5s. 8d. This did not include stock-in-trade, or any of the things mentioned in the Act as being in addition to the award.

Cross-examined by Mr. WEDDERBURN: He did not regard as necessary the filtration of the water from the Town Brook Hollow reservoir. A storage of 140 days' supply was quite sufficient to allow for a place like this. In the matter of compensation water, he did not know that the Company fulfilled their obligations. It was not, to his knowledge, a fact that the Company were taking water from the Motts Road Stream. He doubted very much whether they had any statutory authority to take water from the Motts Road drainage area.

Mr. BALFOUR BROWNE: I am prepared to agree that there was no right to take water from the Motts Road drainage area. I do not see it in the Act.

Mr. WEDDERBURN: Not only have they done all that the Act entitled them to do, but they have made their aqueduct so that they are tapping the water of the Motts Road Stream, and taking all the waters of the Motts Road area.

Witness: No. There may be a pipe; but it is put in such a way that it cannot take the water.

Cross-examination resumed: He agreed the pipe was there, as he had seen it. So far as they were taking from the Light Spout Stream more than 10,000 gallons a day in flood times, they would be doing what they told Parliament they were not going to do. There was no record of the amount of compensation water that had been given in the past. If they confined themselves to taking 10,000 gallons a day from the Light Spout, and gave full compensation, they would have about enough water to supply the existing population with 25 gallons per head per day. With their existing works, under statutory powers, they could supply a population of 3000, and give the compensation water.

The ARBITRATOR: It comes to this. If the Company are to go on doing what they are doing to-day, they can supply up to 3000 people?

Witness: Yes.

Mr. BALFOUR BROWNE: And the question is whether we have the right to do what we are doing to-day.

Mr. WEDDERBURN: And the question also is what you are doing.

The ARBITRATOR: The only question in dispute as to what you are doing is as to this Motts Road.

Cross-examination resumed: He heard that the supply ran short for a few days in 1911, when the people were using very much more than 25 gallons per head. He would say that none of the mains needed replacement. They would go on for 100 or 200 years. In the light of what he knew now, he did not think it would be desirable to filter the New Pool Hollow water, though in 1899 it was his intention to carry out filtration works. After the passing of the Act, the work was transferred to his brother (who was a chemist as well as an engineer); and after thorough investigation, he came to the conclusion that there was not the slightest necessity for filtration. Witness had never made an allowance for a sinking fund to replace mains.

Witness's re-examination concluded the case for the Company.

WATER CHARGES FOR NON-PROVIDED SCHOOLS.

The London County Council had before them, at their meeting on Tuesday last, a report on this subject from the Local Government, Records, and Museums Committee. Questions had arisen in regard to the charges referred to; and the Committee deemed it desirable to draw attention to the matter. They accordingly submitted the following particulars.

On April 25, 1912, the Metropolitan Water Board informed the Council that, as from Oct. 1, 1912, they would be prepared to afford the supply of water to non-provided schools by meter only, in accordance with section 20 of the Board's Charges Act of 1907. Under sections 8 and 9 of this Act, the Council at present pay a water-rate of 5 per cent., less rebate in certain cases, on the rateable value in respect of each provided and non-provided school. As, however, the latter schools are not assessed in the valuation list, annual values in respect of these schools have been agreed with the Board on a basis which the Committee are advised is satisfactory. Section 20 of the Act, under which the Board now propose to charge, provides that "the Board shall not be bound to afford a supply of water otherwise than by measure to any house or building whereof any part is used for any trade or manufacturing purpose for which water is used, or to any common lodging-house, barracks, workhouse, or other public institution or building;" and the Board have been advised that both provided and non-provided schools are public institutions within the meaning of the section. With regard to the effect of the proposal, it is estimated that the amount payable in respect of the 359 non-provided schools at present supplied under sections 8 and 9 of the Act will be £3000 for water, *plus* £200 for meter-rentals, or £3200 a year in all, compared with the present charges of £2600. But about £38 of the increase of £600 is recoverable from the managers. Approximately 150 of the schools require meters to be fixed; but the Committee are advised that the cost will probably be held to be a liability of the managers. Having considered the whole matter, the Committee said they were not pre-

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pared to recommend the Council to contest the proposals of the Board, which would, it was expected, operate as from Jan. 1, 1913. They communicated their views to the Finance and Education Committees; and the former Committee concurred in their decision.

RESPONSIBILITY FOR CHEMICAL PURITY OF WATER.

The following article, dealing with the subject of the responsibility of a public body for the chemical purity of their water supply, recently appeared in "Engineering Record."

Brooklyn, formerly as a city and latterly as a borough of Greater New York, has obtained an important part of its water supply from the sands of the morainal outwash forming the southerly slope of Long Island. Wells and infiltration galleries in these sands usually furnish water of excellent quality; but, for various reasons, some groups of wells have been situated comparatively close to salt water. In these wells, continued heavy pumping has led to a disturbance of the normal relation between the underground fresh and salt waters—producing in time an increase in the chlorine content of the pumped water. Moreover, some groups of wells have already been abandoned for this very reason.

Water high in chlorine, but still unobjectionable for ordinary purposes, has been delivered to consumers in some localities or at some times because of the conditions described. For certain manufacturing purposes, such water, it is claimed, has been found unfit; and at least one party has brought the question to the test of the law on its merits, and carried it through to the highest Court. The Oakes Manufacturing Company, of Steinway, Long Island, have for years been engaged in the production of logwood extracts or dyes. They complained that the water contained so large a percentage of chlorine that it could not be used without special preparation which was so expensive as to eliminate the profits of the business. An action was brought, and the plaintiffs, losing in the Lower Courts, carried the case to the Court of Appeals of the State of New York. A decision was given a few weeks ago by Mr. Justice Hiscock, who dismissed the complaint on its merits. In this decision, the other Justices concurred.

The case, which is of more than passing interest, is thus summarized by the "Law Journal" of New York: "When a city, pursuant to powers conferred upon it, undertakes to maintain a municipal water system, and to supply water to private customers at a fixed compensation, it acts in so doing not in a governmental capacity, but as the proprietor of a corporate business, and is liable as such for breach of its contract or for negligence in connection with the undertaking. But it is not liable, as alleged in this case, for furnishing water containing so large a percentage of chlorine as to be unfit for the plaintiffs' purposes, when the findings are to the effect that it was not possible for the city to procure any other or better water within reasonable limits of expenditure, and that the water furnished was reasonably satisfactory for all purposes except the peculiar and uncommon uses to which it was put in the conduct of the plaintiffs' business."

In the trial, the fact was brought out that the plaintiffs used the water with knowledge of its character, and continued to use it; and a clear distinction was made between such a case and the negligent furnishing of a dangerously insanitary water, the nature of which might not be readily discoverable by the ordinary consumer, who, in ignorance of its character, uses it and suffers. Stress is laid upon the facts that no contract had been made to furnish water suitable for the plaintiffs' unusual purposes, and that it was not possible for the city to secure any other and better supply within reasonable expenditure. The Court also pointed out that, "in discharging such a function as that of furnishing water to citizens, the municipal authorities are necessarily invested with a wide discretion which is not subject to judicial review. Under any ordinary circumstances which do not involve bad faith or a waste of public funds, they must decide whether one source or another shall be sought; and after the supply has been obtained, no Court can say that mains must be laid in every street, or that every resident must have water best suited for his particular needs."

NOTES FROM SCOTLAND.

From Our Own Correspondents.

Saturday.

Edinburgh.—At the meeting of the Council Committee of the Convention of Royal and other Burghs held in Edinburgh on Wednesday—Lord Provost Inches, of Edinburgh, presiding—a letter was read from Mr. W. R. Herring with regard to the question of income-tax allowance and depreciation in reference to gas undertakings. Mr. Herring related the steps that had been taken by these, which had resulted in a financial scheme being adjusted to the satisfaction of private undertakings but to the exclusion of municipal enterprises. The only way, Mr. Herring pointed out, to effect a remedy for the existing state of things was for some representative body to take up the subject with the Income-Tax Commissioners. Lord Provost Inches, in reference to Mr. Herring's communication, recalled that within the last two months two matters had arisen in connection with municipal gas undertakings. One was that they were not to be allowed the same deductions in respect of depreciation when arriving at the annual valuation of the subject upon which they had to pay income-tax as was granted to private gas undertakings; and the other point was that municipal gas undertakings had been prohibited from purchasing residuals from any of their neighbours. It was important for them to keep their eyes open in regard to these matters. Sir Thomas Hunter, the Town Clerk of Edinburgh, remarked that this was evidently one of the steps taken to prevent the extension of municipal undertakings,

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and to give private undertakings privileges. Mr. Herring's letter was remitted to the Burgh Administration Committee, in order that the matter might be taken up, with the expression of opinion already given to be regarded as guidance on the general principle involved.

Brechin.—The Town Council on Wednesday again had before them the question of the proposed acquisition of the gas-works. Communications between the Council and the Gas Company were submitted. A letter from the Company was read refusing to accept the offer already made of £30,000, and asking for a further definite and binding offer which could be submitted to the shareholders. A long discussion took place; it being ultimately decided to leave over the whole question of the municipalization of the lighting of the town.

Doune.—According to circulars issued some time ago, the Town Council met on Monday night to hear objectors to the adoption of the Burghs Gas Act. A petition, with 91 signatures attached, was placed before the meeting objecting to the Council taking over the gas-works; but many of the names on the petition had no *locus standi* as objectors under the Act, owing to not being ratepayers. The Council resolved to advertise for the next three weeks the resolution to adopt the Burghs Gas Act, and then to issue circulars to the ratepayers explaining under what circumstances they have taken over the gas-works.

Dundee.—In the draft Provisional Order being promoted by the Dundee Town Council for the extension of the burgh boundaries by the inclusion of Broughty Ferry and Monifieth, arrangements are outlined for taking over the gas undertakings.

Falkirk.—Provost Bogle presided at the first ordinary meeting of the Town Council on Monday. From the minute of the meeting of the Gas-Works Committee, it appeared that approval had been given to the Gas Manager erecting one or two high-pressure lamps, which were promised on loan, in Newmarket Street, in front of the Town Hall. It was agreed to grant an increase of 3d. per shift on the wages of machinemen employed at the gas-works.

Perth.—On Wednesday, the Town Council visited the gas-works at Friarton for the purpose of inspecting the carbonizing plant. The members made a minute examination of the working of the plant and of the repairs rendered necessary by the recent collapse of some retort fittings. Some discussion took place; and it was ultimately agreed to ask the advice of an expert in connection with the matter.

Genoa Water Supply.—It will be seen, from a paragraph which appears elsewhere, that a company has been formed to provide Genoa with a pure water supply, in place of what is now known to be a deficient one. According to the "Financial News," the undertaking has been visited and fully investigated by Sir Alexander Binnie, Son, and Deacon, who report that the business is likely to prove of a remunerative character. Mr. W. J. E. Binnie, a partner of the firm, has joined the Board as Technical Adviser.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *Nov.* 23.

Sulphate of Ammonia.

Throughout the week there has been a want of animation in the market for this material, and no quotable change has taken place in prices. On the one hand, buyers have largely refrained from making further purchases, while, on the other hand, there has been no pressure on the part of sellers to dispose of their goods. At the close, the nearest values still are £13 16s. 3d. per ton f.o.b. Hull, £13 17s. 6d. per ton f.o.b. Liverpool, and £13 18s. 9d. per ton f.o.b. Leith. Manufacturers are now more inclined to modify their views as regards values in the forward position, but dealers continue to underquote them by 2s. 6d. to 5s. per ton.

Nitrate of Soda.

There is no alteration in either the tone or the price of this article, and spot quotations are repeated at 11s. 9d. per cwt. for ordinary quality, and 11s. 10½d. for refined.

LONDON, *Nov.* 25.

Tar Products.

Business is still somewhat quiet in the market for tar products. In pitch, there is not much new business to be had, and several lots have been offered during the week at slightly lower prices on the east and west coasts. Benzols remain the same. Solvent and heavy naphthas continue fairly firm; but consumers appear to be holding off from purchasing, in the hope that they may see lower prices. Crude carbolic is still in a very unsatisfactory state. It is mentioned that 2s. 3d. to 2s. 4d. per gallon has been paid for prompt delivery. Actual consumers will not look at anything like these prices—in fact, for next year, they will not pay anything above 1s. 11d. to 2s. per gallon. Creosote remains very firm, and the inquiry is good.

The average values during the week were: Tar, 26s. 3d. to 30s. 3d. Pitch, London, 43s. to 43s. 6d.; east coast, 42s. 6d. to 43s.; west coast, Clyde, 43s. to 43s. 6d.; Manchester, 40s. 6d. to 41s. 6d.; Liverpool, 41s. 6d. to 42s. 6d. Benzol, 90 per cent., naked, London, 11d. to 11½d.; North, 10d. to 10½d.; 50-90 per cent., naked, London, 11d.; North, 10½d. to 10¾d. Toluol, naked, London, 11½d. to 1s.; North, 11d. to 11½d. Crude naphtha, in bulk, London, 5½d. to 5¾d.; North, 5d. to 5⅛d. Solvent naphtha, naked, London, 1s. 1½d. to 1s. 2d.; North, 1s. 1½d. to 1s. 2d. f.o.b. Heavy naphtha, naked, London, 11½d. to 1s. f.o.b.; North, 10½d. to 11d. f.o.b. Creosote, in bulk, London, 3⅛d. to 3¼d.; North, 3d. to 3⅛d. Heavy oils, in bulk, 3⅜d. to 3½d. Carbolic acid, casks included, 60 per cent., prompt east coast, 2s. 3d. to 2s. 4d.; east coast, forward 1s. 11d. to 2s. 1d. Naphthalene, £5 to £9; salts, 45s. to 50s., bags included. Anthracene, "A" quality, 1½d. to 1⅝d. per unit, packages included and delivered.

Sulphate of Ammonia.

There is practically no change in the market for this article. Very few orders come into the market; and it is somewhat surprising

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that buyers are holding off as they are doing. Outside London makes are still quoted at £13 5s. Hull is £13 16s. 3d.; Liverpool £13 17s. 6d.; Leith, £13 18s. 9d. The majority of makers are holding for much higher prices for the forward position; but dealers are offering at several shillings a ton under the price of the manufacturers.

COAL TRADE REPORTS.

Durham and Northumberland.

There is generally a good demand for coals, though steam varieties show the weakness usual at this time of the year. Best Northumbrian steams are from 13s. 6d. per ton f.o.b.; second-class steams are from 12s. 9d. to 13s.; and steam smalls about 9s. 9d. to 11s. Production is tolerably full at present. In the gas coal trade, there is now an inquiry which is about at its fullest, and which causes the output to be well taken up by the long contracts; so that there is not any large surplus for sale. Best Durham gas coals are from 15s. to 15s. 3d. per ton f.o.b.; second-class gas coals are from 14s. 3d. to 14s. 6d.; while "Wear specials" are near 16s., and are scarce. In contracts, there have been more sales of cargoes for Genoa; but high freights make coals dear at these ports. A contract for some 20,000 tons of second-class coal for shipment over the first six months of next year has been made at 14s. 3d. per ton, and 14s. 6d. for bests. The Helsingborg contract has also been settled, at a delivered price equal to 13s. 6d. per ton f.o.b.; while the Palermo Gas-Works will need 20,000 to 26,000 tons for next year, and are now in the market. The production of gas coals is heavy; but the demand is very great. Coke is steady. Gas coke is in large output, with the price from 22s. to 23s. per ton f.o.b. for good makes.

Scotch Coal Trade.

The coal trade throughout Scotland is well employed in all departments, and prices rule steady. On the Glasgow Coal Exchange on Friday, the following were the prices quoted f.o.b. Glasgow: Steam coal, 11s. 6d. to 12s.; splint, 14s. to 14s. 6d.; ell, 12s. 3d. to 12s. 9d.; trebles, 12s. 6d. to 13s.; doubles and singles, 12s. to 12s. 6d.

Damage to Gas-Mains at Drogheda.—The question of a large leakage of gas from the mains, and the inconvenience caused to trade and the citizens generally by the want of pressure and the consequent unsatisfactory light, was considered last Thursday at the meeting of the Drogheda Town Council. A report was read from Mr. H. W. Saville, the Gas Engineer and Manager, who suggested that the leakage was due to a number of breakages of the mains caused by the dislocation of the subsoil by the steam-roller. He said the Corporation were losing from 8000 to 10,000 cubic feet of gas per day. The Borough Engineer doubted that the steam-roller was the cause of the fractures. The Council referred the matter to Mr. Saville and the Borough Engineer.

Electric Light Failures.

Under the heading "Paris by Candle-Light," the Paris Correspondent of "The Times" wrote last Tuesday as follows: "During the sitting of the Senate this afternoon, the electric light in the Chamber suddenly went out; and during the half hour necessary to set going the disused gas installation, each Senator was provided with a candle, while a lamp was hung by the President's chair. Simultaneously the electricity failed throughout the Saint Michel and Saint Germain quarters, and the inhabitants were forced to fall back on lamps and candles. Parisians were irresistibly reminded of the days of the Pataud strike in 1910." The Corporation electricity supply at Bolton failed last Thursday night for half an hour. The tramcars stopped, hundreds of shops were plunged into darkness, and shopkeepers had to light candles and lamps. On the same night the electric light failed at Lynton and Lynmouth—the result, it is stated, of the bursting of a water-pipe. Machinery stopped working; both the towns were in darkness; and public gatherings were postponed.

Large Water Scheme for Westmorland.

Mr. A. W. Brightmore, M.Inst C.E., held an inquiry last Thursday into an application made to the Local Government Board by the West Ward Rural District Council for authority to raise £35,600 for carrying out the scheme of water supply referred to in the "JOURNAL" for the 19th inst. (p. 622). The Engineer for the scheme is Mr. J. Graham, of Carlisle. It was mentioned in the course of the inquiry that, since the application was made, the cost of materials had increased to such an extent as to raise the estimate to £39,000. There was some opposition to the Council's proposals. Mr. Graham fully explained the scheme, which was stated by Mr. G. Midgley Taylor, M.Inst.C.E., to have been designed on good and economical lines, so far as engineering was concerned. Mr. D. Balfour, of Newcastle, gave particulars of a plan he had prepared for an independent supply for Askham and Helton—a protest having been made against the inclusion of the former place in the scheme; and Mr. H. W. Taylor, also of Newcastle, submitted and explained his proposals for supplying Bampton and Crosby Ravensworth independently. Lord Lonsdale, the principal landowner, from whom the water rights have been provisionally obtained, sent a letter in which he expressed the opinion that the Council's scheme was a bold and comprehensive one, and calculated to afford an adequate supply of good water; but he said that, relatively to the population and the rateable value of the area to be served, it was unquestionably a very costly one. He, however, fully recognized the advantage of an abundant supply of pure water; and if the Local Authority and the Local Government Board, after fully considering the needs of the district, population, rateable value, and available sources of supply, were of opinion that the scheme was the best and most satisfactory one, he was prepared to afford every reasonable facility for carrying it out. At the close of the inquiry, the Inspector and the Engineers visited the district.

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LEST YE FORGET.

Norwich Public Lighting.

At the meeting of the Norwich Town Council last Tuesday, Mr. F. C. Havers moved that, as recommended by the Executive Committee, electric light be substituted for gas for public street lighting in the remainder of the city; the substitution to be completed by Oct. 1, 1913. He said the recommendation would affect some 734 lamps; the two previous resolutions having been concerned with 1537. If the proposal were approved, the total number of lamps within the city and county of the city would be just over 2500. Mr. Thompson said a widespread belief existed among the citizens that the lighting of the streets was not so good now as it was when they were lit by gas. The majority of the main roads and thoroughfares were well lighted, but not the side streets. Councillors frequently received complaints on this score. Mr. Joseph thought the reason why there was complaint as to insufficiency of lighting was because all the lamps were placed on one side of a street only. Mr. E. Wild, representing the Electricity Committee, dealing with Mr. Joseph's remark, pointed out that in the substitution of electric light for gas they had taken over the gas-lamps, and placed electric lights therein. If a street was lighted on one side now, it was because it was lighted in like manner before by gas. The recommendation was agreed to.

New Artesian Well at Wembley.—In the construction of a new artesian well which has been completed at Wembley for the London and North-Western Railway by the Artesian Well-Boring Company, a 15-inch bore was taken down to a depth of 250 feet, from which point it is 12 inches diameter for another 250 feet. The well is lined with a steel tube for 300 feet, and a 4-inch supply-pipe is also taken down to this depth, as well as a 2-inch compressed air main to supply the air necessary to raise the water by the air-lift method. It was anticipated before the well was constructed that a supply of about 8000 gallons of water an hour would be available; but recent tests have shown that a flow of more than 15,000 gallons is obtainable, and that there is every likelihood of this quantity being maintained. The present well, which is largely in the nature of a trial bore, will be followed by others.

New Joint-Stock Companies.—Among the new joint-stock companies recently registered are: The British Graetzin Light, Limited, with a capital of £20,000, in £1 shares. Krupka and Jacoby, Limited, dealers in electric lighting appliances, with a capital of £5000, in £1 shares. Genoa and District Water-Works Company, Limited, with a capital of £200,000, in £1 shares. The object of the Company is to acquire three concessions from the Municipality of Genoa and the communes of Sampierdarena and Cornigliano Ligure, together with land and rights and fixed plant at the first and last named places; to adopt certain agreements; and to carry on the business of a water company in all its branches. The purchase consideration is £31,100 in cash and £105,000 in shares. Among the first Directors are Mr. J. Jackson, J.P., Chairman of the Kimberley Water-Works Company, and Mr. W. J. E. Binnie, M.Inst.C.E.

The Gas Classes at the Westminster Technical Institute.

The report of the Education Committee of the London County Council on this subject which appeared in the "JOURNAL" last week (p. 617) is on the *agenda* for the meeting of the Council to-day. The Committee stated that in addition to the salary of £2 10s. per week for a workshop instructor there would be an outlay of £5 a year for lighting. They added that during the current financial year the gross expenditure involved would be about £45, while the net cost would be £3, provision for which had been made in the annual maintenance votes for 1912-13. During the financial year 1913-14, the gross expenditure would be £126, and the net cost, after allowing for Board of Education grants and fees from the Gaslight and Coke Company, would be £9. Ultimately the gross expenditure would be £63 a year, while the net expenditure would be £5 a year. The Committee had informed the Finance Committee of their proposals, and recommended that whole-time day courses of training in joint-wiping should be provided for the apprentices in question, each course to cover a period of six weeks; that admission to the classes should be conditional upon the Company paying a fee of £1 in respect of each apprentice; and that a whole-time instructor should be employed for a period of three years, and thereafter for half time, at a rate of pay of £2 10s. per week. The Finance Committee had no observations to offer on the proposals.

Sale of Windsor Gas Shares.—Twenty-two fully-paid original shares of £20 each in the Windsor Royal Gas Company were sold last Thursday at the Castle Hotel, Windsor, by Messrs. Buckland and Sons, and realized £43 5s. and £43 10s. each. Twelve preference shares of £8 each, fully-paid, were sold at £10 apiece; and eighteen new shares of £20 each, upon which £8 had been paid, fetched from £11 to £11 5s. each.

Chemical Manufacturers and the Residuals Inquiry.—A joint meeting of the Chemical Section of the London Chamber of Commerce and the Association of Tar Distillers has been held at which it was resolved to support by evidence the case of the Alkali Manufacturers' Association before the Joint Parliamentary Committee who are inquiring into the residuals question. A Special Committee was appointed to decide as to the nature of the evidence to be given.

The Dangerous Chandelier Again.—An escape of gas from a chandelier in an unfurnished room on the premises of Messrs. Salter and Salter, in High Street, King's Lynn, caused an explosion and a serious fire on the 15th inst. The manager entered the room to open a window; and, detecting what he thought was only a slight escape of gas, struck a match and drew down the chandelier to locate the source of the trouble. He found it at the expense of burnt hair and clothes and damage to the premises. The latter would have been very serious but for the prompt action of members of the next-door firm's fire brigade, who brought their appliances into operation, and used them with much skill.

THE PIONEERS OF THE SLOT METER.

FIRST IN 1889.

FOREMOST 1912.

THE INTRODUCTION OF THE SLOT METER.

WRITING to supplement the information given in our "Questions and Answers" column last week with regard to the introduction of the slot meter, a correspondent says that the first patentee was Mr. W. Brownhill, but his meter was never in practical use. The first Gas Company to supply gas in quantity through slot meters was the Liverpool United Gas Company. They supplied gas in bulk to the Corporation for the artisans' dwellings in Casino Street, Liverpool. The Corporation fixed 50 penny-in-the-slot meters in these dwellings. The meters were Thorp and Marsh's patent, and they were manufactured by Messrs. Sawer and Purves. The meters were fixed for six months on approval, at the end of which time the Corporation had to decide whether they were a success or failure. Mr. Marsh entered into a guarantee that the meters should be satisfactory, and he undertook liability for any accident that might occur. Our correspondent adds that he has no hesitation in saying that Sir George Livesey was the first man controlling a gas undertaking to strenuously advocate the use of the slot meter.

GAS v. ELECTRICITY

(From the GAS WORLD.)

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Infirmary Lighting by Incandescent Gas.—At a meeting of the Lewisham Board of Guardians on Monday last week, an offer was considered from the South Metropolitan Gas Company to fit up one of the wards at the Infirmary with their improved incandescent lighting. The Board agreed to accept the offer, subject to the Company giving a written undertaking that they would, at their own cost, provide all necessary fittings, and fix a separate check meter to the ward, and also one to another ward so as to make a comparison of the cost of gas consumed by the two systems. The Board viewed the experiment with great interest.

Nuneaton Water Supply.—At the meeting of the Nuneaton Town Council last Wednesday week, the Water Committee reported having received the sanction of the Local Government Board to a loan of £10,000 for the completion of the Griff water scheme. Mr. Melly, in moving the adoption of the report, explained that the acquisition of this additional supply had become necessary to meet the requirements of the town. It was true that the yield was not so great as had been anticipated; but it was sufficient to well compensate them for the outlay the Council were incurring. When the Griff pit was sunk twenty years ago, there was a yield of about 1,250,000 gallons a day; but there was nothing like this quantity now. They had spent about £6000 on sinking and driving headings, and the remaining £4000 was wanted for the completion of the works. They had every reason to believe that they would get about 250,000 gallons of water daily from the new sinkings; and this, with the existing supply, would be sufficient to meet their needs for some years to come. The report was adopted.

Oriental Gas Company, Limited.—In the report which the Directors of this Company will present at the ordinary general meeting to-morrow, they state that the revenue account for the year ended the 30th of June last is satisfactory; the aggregate of receipts being nearly equal to the unprecedentedly high figures attained in the preceding year. The amount of gas-rental is lower—the result of a smaller quantity of gas being required for the public lighting than was needed under the old system. But the revenue received from the private consumers exhibits considerable growth, notwithstanding the reduction in the price of gas made in their favour; and the important item of residual products shows an increase which has nearly redressed the deficiency. The projected operations which were placed before the proprietors a year ago, and were then approved by them, have been successfully carried into effect, together with other works the advisability of which became manifest in the course of the development of these operations and of the Company's business in general. The reserve fund has furnished £15,000 to meet the outlay incurred, which the Directors are confident is, economically, an excellent investment of the money. The twenty years' contract with the Corporation of Calcutta, the commencement of which was postponed to the 1st of March last, duly commenced on that date. The accounts accompanying the report show a balance of £19,500 on the profit and loss account; and the Directors recommend the payment of the usual dividend of 4½ per cent., free of income-tax—making a total dividend of 8 per cent. for the year.

Dispute as to a Dublin Corporation Water-Works Contract.—In the Chancery Division of the High Court of Justice in Ireland last Thursday, Mr. Justice Barton, on the application of the Solicitor-General (Mr. Ignatius O'Brien), instructed by Mr. Ignatius J. Rice, Law Agent to the Dublin Corporation, granted an interim injunction against Messrs. M'Kee and M'Nally, contractors, who were or had been engaged in the construction of an additional reservoir at the Roundwood (Co. Wicklow) works, from which Dublin receives its water supply. The cost of the works in progress is stated to be about £80,000; and a dispute arose which, Counsel asserted, left the Corporation in the position that they would have to take over the job and complete it. The injunction was to prevent the contractors from removing material and plant from the place.

Provision of Light for Caton.—Messrs. Storey Bros., Limited, who have for many years manufactured, at their mill at Caton, near Lancaster, sufficient gas to light the public highways and supply about twenty customers, have decided to introduce electricity and cease lighting beyond their own property. A meeting of the residents has consequently been held to consider what steps should be taken to provide an illuminant. A strong feeling was manifested in favour of obtaining a supply of gas from the Lancaster Corporation; but it was pointed out that the laying of mains would cost £2000, and £500 more would be required to make the connections. With an expenditure of £2500 at 4 per cent., the residents would want £100, and £35 for depreciation. This meant a sale of 950,000 cubic feet of gas in order to make the scheme pay. A Committee was, however, formed to take steps to provide the village with light.

Burton-upon-Trent Gas Committee and Traders.—We learn from the "Ironmonger" that the Gas Committee of the Burton-upon-Trent Corporation received on Monday last week a deputation of ironmongers and gas-fitters in connection with the Committee's proposition to let on hire and fix gas-fires and outside lamps, to which reference was made in the "JOURNAL" for the 29th inst. (p. 614). The deputation was introduced by Mr. R. H. Smith, the General Secretary of the Ironmongers' Federated Association, who said he found the Act of 1896, under which the Committee were working, gave the Corporation power not only to sell and let on hire gas appliances and fittings, but also to manufacture them. Such powers were very unusual, and put the deputation in the position of the weak appealing to the strong; but it was in this way that they appealed to the Committee. After some discussion, the deputation retired while the matter was considered. On being recalled, they were informed that the Committee had decided to pay 2s. 6d. for all direct orders obtained for the hiring-out of stoves, while the whole of the fitting should be done by the traders. The Chairman (Alderman Lowe) also gave an undertaking that in dealing with any complaints that came direct to the Committee, their men should only clean out burners, &c.; and that if new mantles and fittings were required, they should be bought through the trade. With regard to the exhibition of gas-fires to be held in the various ironmongers' shops, the Corporation would supply stoves on sale or return.

PARKINSON PROGRESSION.

THE "ROYAL."
One of our Earliest Patterns.

A glance at the two illustrations will show the big stride we have made in Gas Fire Progress (the result of exhaustive experiments).

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on account of their Scientific and Practical Construction, which ensures

HEALTHFUL & ECONOMICAL HEATING.

THE
PARKINSON STOVE CO., Ltd.,
BIRMINGHAM & LONDON.

THE "PATHAN."
One of our Latest Patterns.

Water Supply in the Wakefield District.—The Corporation of Wakefield, acting on the advice of Mr. C. Clemesha Smith, M.Inst.C.E., their Water-Works Engineer, have decided to lay an 18-inch main, between six and seven miles in length, from the city to Waindyke, to improve the supply to Castleford, Whitwood, Featherstone, and the surrounding districts. Application is to be made to the Local Government Board for power to borrow £20,000 for the purpose.

Shoeburyness Gas-Works Extensions.—In the course of a Local Government Board inquiry regarding an application by the Shoeburyness Urban District Council for sanction to borrow £2000 for the purposes of their gas undertaking, it was stated that £500 was required for extending the purifiers. The Inspector (Mr. T. C. Ekin) inquired what period was asked for this portion of the loan; and Mr. J. Glasscock (a member of the Council) replied fifty years. The Inspector: The Board never allow more than thirty years. Mr. Glasscock: I know that; but I thought you might get us fifty years, so that the rising generation might pay the loan off. The Inspector: All the authorities are asking for the same thing. They want those who are to follow them to do the paying. Other sums, it was explained, were wanted for meters, services, and mains. There was no opposition to the application.

Adelaide Water Supply.—According to a statement in the Engineering Supplement to "The Times" last Wednesday, the recommendation of the Royal Commission appointed to investigate the water supply of Adelaide and district, that a reservoir should be formed at Millbrook on the Torrens River, is endorsed by an engineer who has been instructed to inquire into the scheme, and a copy of his report, with a plan showing the site of the proposed work, is now in the possession of the Commercial Intelligence Branch of the Board of Trade. The reservoir is to be made by the construction of an earth embankment about 800 feet long, 90 feet high, and 480 feet wide at the base. The greatest depth of water near the embankment will be 82 feet, and the water area will be 370 acres. A concrete weir 150 feet long and 32 feet high is also to be provided, as well as a conduit 2350 yards long, of which 1760 yards will be in tunnel.

New Water-Works at Warrenpoint.—The new water-works at Warrenpoint, the well-known Co. Down holiday resort at the head of Carlingford Lough, were opened last week without ceremony. Mr. Swiney, the Engineer of the works, informed the Urban District Council that the water was darker in colour than it should be; but this was due to recent heavy rains.

Province of Buenos Ayres Water-Works Company.—The report of the Directors of this Company to be presented at the ordinary general meeting on Thursday shows that the profits for the year ended the 30th of June last amounted to £21,496; making with the balance brought forward a total of £22,383. The Directors recommend a final dividend at the rate of 4 per cent. per annum, and propose to place £6500 to the contingency account, and to carry forward £4083. Until the constructional work now in hand is completed, a proportion of the revenue outlay in Buenos Ayres is still being charged to capital. All matters connected with the rating of the properties served have been amicably adjusted between the Company and the local authorities, all new assessments are being easily arranged, and the collection of water-rates is proceeding satisfactorily. Extensions of mains are constantly being made; there being now a total of 108¾ miles.

Portsmouth Water Company.—The half-yearly general meeting of this Company was held last Thursday, Lieut.-Colonel C. Lanyon Owen, J.P., in the chair. The accounts presented showed a revenue of £40,166, and an expenditure of £17,408; leaving a profit of £22,758. The amount available for distribution was £25,065; and the full statutory dividends were recommended, leaving a balance of £4800 to be carried forward. It was stated in the report that the new mains laid brought up the total to 67½ miles of trunk and about 170¼ miles of street service mains. In moving the adoption of the report, the Chairman remarked that the half year had been uneventful, and that in all departments the work of the Company had been going on well. Their supply was unsurpassable; and though some had questioned the necessity for the filtration works, the Company were fully justified in ensuring the health of the town. The report was adopted.

GAS COMPANIES' STOCK AND SHARE LIST.

The brightness of the previous week on the Stock Exchange was too good to last into the week just concluded. War apprehensions were at the bottom of it all. The failure of the first attempt at negotiations between the belligerents, the rumours of mobilization on a vast scale by more than one Great Power, and the secrecy shrouding actual operations which made men prone to imagine the worst, were the dominant factors. An occasional ray of hopefulness brightened the horizon now and then, but not for long; and the feeling at the close was nervous. It was only the internal strength of markets that preserved them from bad falls. The opening on Monday was dull and heavy; and some departments remained so all day. Government issues showed no animation, Rails amended a little, and then became irregular; and the rest were no better. Tuesday was quite flat; the political outlook being too gloomy. Gilt-edged shrank, and Consols fell ¼. Rails and Americans gave way; and the Foreign Market was not happy. Wednesday, however, was not so depressed; and a recovery was made in many lines. Consols got back their lost ¼, Rails were better, though some movements obeyed special influences, and Foreign improved. Thursday opened in similar mood, and business quickened up with rising prices. But presently came reaction; and they fell almost back again. On Friday, the general tendency was weak; but no fall of magnitude took place. Government issues were easier, except Consols. Rails gave way all along the line on sales; but Americans were a trifle firmer. Saturday showed increased weakness; Balkan affairs inducing apprehension, and Foreign Bourses seeming nervous. Government issues were steady; but other chief markets were lower. Consols closed without change for the week—viz., 75⅛ to 75⅜. In the Money Market, movements were changeable—at first easy, then hardening, and finally easy again. Business in the Gas Market was quite satisfactory—apparently quite exempt from the troubles which beset the larger and more frequented departments. Activity was fairly developed, and strength was manifested by advanced quotations. In Gaslight and Coke issues, the ordinary showed a good array of transactions, rising from 102⅜ to 103½—an advance of ⅛. In the secured issues, the maximum realized 84 (a rise of ½), the preference 101½, and the debentures 77 and 78—a rise of ½. South Metropolitan was quite active and strong, changing hands at 116¾ to 117⅜. In Commercials, the 4 per cent. made from 106½ to 107½; and the 3½ per cent. 101⅛ and 102½. Among the Suburban and Provincial group, Alliance and Dublin was done at 77½, Bournemouth preference at 14 3/16, British at 45 and 45½ (a rise of ½), Ilford "A" and "C" at 157, South Suburban at 119 (a rise of 2), ditto debenture at 121½, and Tottenham "B" at 115 and 115½. In the Continental companies, Imperial marked from 177 to 179, ditto debenture 86¾, Union 81¾, and European 19⅛ and 19¼. Among the undertakings of the remoter world, Bombay realized 6⅜ and 6½, Monte Video 11⅜, Oriental 132½ and 133½ (a rise of 1), Primitiva from 6⅜ to 6⅝, ditto preference from 5 to 5 5/32, and River Plate debenture 93½.

Issue.	Share	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.				£ s. d.
1,551,868	Stk.	Oct. 11	5	Alliance & Dublin Ord.	76—81	..	6 3 5
374,000	Stk.	July 12	4	Do. 4 p.c. Deb.	89—91	..	4 7 11
250,000	5	Oct. 11	7½	Bombay, Ltd.	6⅜—6⅝	..	5 9 1
50,000	10	Aug. 29	15	Bourne- } 10 p.c.	28—29	..	5 3 5
332,000	10	,,	7	mouth Gas } B 7 p.c.	14—14½	..	4 2 9
75,000	10	,,	6	and Water } Pref. 6 p.c.	257—262	..	5 3 1
380,000	Stk.	Aug. 14	13½	Brentford Consolidated	197—202	..	5 4 0
330,000	,,	,,	10½	Do. New	116—118	..	4 4 9
50,300	,,	,,	5	Do. 5 p.c. Pref.	96—98	..	4 1 8
206,250	,,	June 14	4	Do. 4 p.c. Deb.	210—215	..	5 2 4
218,230	Stk.	Aug. 29	11	Brighton & Hove Orig.	152—155	..	5 3 3
244,200	,,	,,	8	Do. A Ord. Stk.	44⅛—45½	+⅛	5 9 11
530,000	20	Sept. 27	12½	British	91—93	..	4 6 0
120,000	Stk.	June 28	4	Do. 4 p.c. Deb. Stk.	93—95	..	4 4 3
215,771	Stk.	June 28	4	Buenos Ayres 4 p.c. Deb.	2—3	..	—
100,000	10	—	—	Cape Town & Dis., Ltd.	3½—4⅜	..	—
160,000	10	—	—	Do. 4½ p.c. Pref.	70—73	..	6 3 3
100,900	Stk.	June 28	4½	Do. 4½ p.c. Deb. Stk.	110—112	..	4 9 3
157,150	Stk.	Aug. 29	5	Chester 5 p.c. Ord.	106—108	..	5 1 2
1,513,280	Stk.	Aug. 29	5/9/4	Commercial 4 p.c. Stk.	101—103	..	5 3 6
560,000	,,	,,	5½	Do. 3½ p.c. do.	73—75	..	4 0 0
475,000	,,	June 14	8	Do. 3 p.c. Deb. Stk.	80—83	..	4 16 5
800,000	Stk.	May 31	4	Continental Union, Ltd.	133—135	..	5 3 8
200,000	,,	,,	7	Do. 7 p.c. Pref.	124—125	..	4 12 0
492,270	Stk.	—	5⅞	Derby Con. Stk.	103—105	..	3 16 2
55,000	,,	—	4	Do. Deb. Stk.	19—20	..	5 0 0
1,002,140	10	July 26	10	European, Ltd.	102—104	+½	4 13 8
1,160,600	Stk.	Aug. 14	1/17/4	Gas- } 4 p.c. Ord.	81—85	+½	4 2 4
2,600,000	,,	,,	3½	light } 3½ p.c. max.	93½—101½	..	3 18 10
4,062,235	,,	,,	4	and } 4 p.c. Con. Pref.	76½—78½	+⅛	3 16 5
4,631,705	,,	June 14	3	Coke } 3 p.c. Con. Deb.	91—93	..	5 7 6
258,740	Stk.	Sept. 13	5	Hastings & St. L. 3½ p.c.	—	..	—
82,500	,,	,,	6½	Do. do. 5 p.c.	16—16½	..	6 13 4
70,000	10	Oct. 11	11	Hongkong & China, Ltd.	154—157	..	4 17 1
131,000	Stk.	Sept. 13	7⅝	Ilford A and C	121—123	..	4 19 7
65,780	,,	,,	6½	Do. B	91—93	..	4 6 0
65,500	,,	June 28	4	Do. 4 p.c. Deb.	175—180*	..	5 0 0
4,940,060	Stk.	Nov. 14	9	Imperial Continental	86—88	..	3 19 7
1,935,000	Stk.	Aug. 14	3½	Do. 3½ p.c. Deb. Red.	122—125	..	4 16 0
200,242	Stk.	Aug. 29	6	Lea Bridge Ord. 5 p.c.			

Issue.	Share	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.				£ s. d.
561,000	Stk.	Aug. 29	10	Liverpool United A.	216—218	..	4 11 9
718,100	,,	,,	7	Do. B.	155½—157½	..	4 8 11
306,083	,,	June 28	4	Do. Deb. Stk.	100—102	..	3 18 5
63,480	Stk.	June 28	3	Maidstone 3 p.c. Deb.	69—71	..	4 4 6
75,000	5	June 14	6	Malta & Mediterranean	4⅜—4⅝	..	6 3 1
250,000	100	Oct. 1	4½	Met. of } 4½ p.c. Deb. Melbourne }	99—101	..	4 9 1
541,920	20	Oct. 30	3½	Monte Video, Ltd.	11½—11⅞	..	5 19 2
1,775,892	Stk.	July 26	4½	Newc'tle&G'tesh'd Con.	99½—100	+½	4 7 6
529,705	Stk.	June 28	3½	Do. 3½ p.c. Deb.	87—88	+1	3 19 7
55,940	10	Aug. 29	7/7/0	North Middlesex 7 p.c.	133—143	..	5 1 5
300,000	Stk.	May 15	8	Oriental, Ltd.	130—135	+1	5 18 6
60,000	5	Sept. 27	10	Ottoman, Ltd.	8⅛—8⅜	..	5 14 3
60,000	50	Aug. 14	13	Portsea Island B	127—130	..	5 0 0
100,000	50	,,	12	Do. C	124—127	..	4 14 6
249,980	5	Oct. 11	8	Primitiva Ord.	6⅛—6⅜	—⅛	5 18 6
499,960	5	June 28	5	Do. 5 p.c. Pref.	5—6¼	..	4 15 3
521,600	100	June 1	4	Do. 4 p.c. Deb.	96—98	..	4 1 8
346,198	Stk.	June 28	4	River Plate 4 p.c. Deb.	93—95	..	4 4 3
275,000	5	Apl. 12	12	San Paulo, Ltd.	13—14	..	4 5 9
150,000	10	Sept. 27	6	Do. 6 p.c. Pref.	11½—12	..	5 0 0
125,000	50	July 1	5	Do. 5 p.c. Deb.	49—51	..	4 18 0
135,000	Stk.	Aug. 29	10	Sheffield A	230—232	..	4 6 2
209,984	,,	,,	10	Do. B	230—232	+1	4 6 2
523,500	,,	,,	10	Do. C	229—231	..	4 6 7
90,000	10	Sept. 27	7½	South African	9—10	..	7 10 0
6,429,895	Stk.	Aug. 29	5/9/4	South Met., 4 p.c. Ord.	116—118	..	4 12 8
1,895,445	,,	July 12	3	Do. 3 p.c. Deb.	76—79	..	3 15 11
209,820	Stk.	Aug. 14	8½	South Shields Con. Stk.	163—165	..	5 3 0
605,000	Stk.	Aug. 14	5/16/8	S'th Suburb'n Ord. 5 p.c.	119—121	+2	4 16 3
60,000	,,	,,	5	Do. 5 p.c. Pref.	117—119	..	4 4 0
117,058	,,	July 12	5	Do. 5 p.c. Deb. Stk.	120—122	..	4 2 0
594,740	Stk.	Nov. 14	5	Southampton Ord.	102—105*	..	4 15 3
120,000	Stk.	Aug. 14	7½	Tottenham } A 5 p.c.		..	5 0 0
483,940	,,	,,	5½	and } B 3½ p.c.	142—145	..	4 19 2
149,470	,,	June 28	4	Edmonton } 4 p.c. Deb.	114—116	..	4 3 4
182,380	10	June 15	5	Tuscan, Ltd.	94—96	..	5 15 11
149,900	10	July 1	5	Do. 5 p.c. Deb. Red.	8⅝—8⅞	..	5 1 0
236,476	Stk.	Aug. 14	5	Tynemouth, 5 p.c. max.	97—99	..	4 6 7
255,636	Stk.	Aug. 29	6⅞	Wands- } B 3½ p.c.	115—115½	..	4 17 6
85,766	,,	June 28	3	worth } 3 p.c. Deb. Stk.	133—141	..	4 3 4
					70—72	..	

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The Richmond Gas Stove and Meter Company, Limited, have recently received an order to supply an extensive installation of special apparatus, consisting of large ranges, steamers, hoods, &c., for the National Insurance Commission, Maida Vale. This order (which was secured in open competition) will supply the department with a full equipment of gas apparatus for culinary purposes to all the employees.

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LITTLEHAMPTON GAS COMPANY. By Auction. 25, High Street, Littlehampton. Dec. 4.

Stocks and Shares—*continued.*

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FOR

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[*See Article in* "Journal" *for Oct.* 1, *p.* 20.]

PRESS OPINIONS.

"With infinite patience and considerable skill, the author has collected, boiled down, and arranged much matter that has hitherto lain buried in periodicals, papers, and reports—matter that every salesman ought to have ready to mind and to hand when the psychological moment arrives, as it must to every salesman, when the ready answer to the awkward question turns the scale to the side of success. . . . It is not meant to imply that the book is a mere collection of stock phrases and quotations that the merest parrot of a salesman can reel off to order."—*The Gas World.* [some suggestions for improvement in sundry forms of expression appear in the review.]

"'Competition Points for Gas Salesmen' is the title of a useful octavo volume. . . The author has skilfully compiled within two covers many comprehensive points collected from various sources, and garnished with his own observations. It will be found helpful to show-room attendants, canvassers, inspectors, collectors, and others upon whom gas undertakings depend for maintaining and extending the sale of gas. . . . We congratulate the author on his work."—*Gas.*

"The author gives a well-arranged mass of information concerning the uses of town gas and the shortcomings of its competitors. We very heartily commend this useful little handbook to our readers. It is well got up, and very cheap. We do not say it is above criticism—the author himself does not go to that length. . . .—but we do compliment Mr. Bezant on the careful and skilful preparation of a collection of 'points' which will be found of great use to many who are engaged on the commercial side of the gas industry, and not uninteresting to those of more exclusively technical pursuits."—South Metropolitan Gas Company's *Co-partnership Journal.*

The author "has just enough bias in favour of gas to give his book a little spice, and withal he is too fair-minded to make extravagant statements when controverting the claims made for rivals to gas. . . . The matter is presented with a freshness which should appeal to a wider circle than those for whom the book is primarily intended. . . . Altogether we have here a book which is different from anything previously attempted."—*The Ironmonger.*

LONDON: WALTER KING, 11, BOLT COURT, FLEET STREET, E.C.